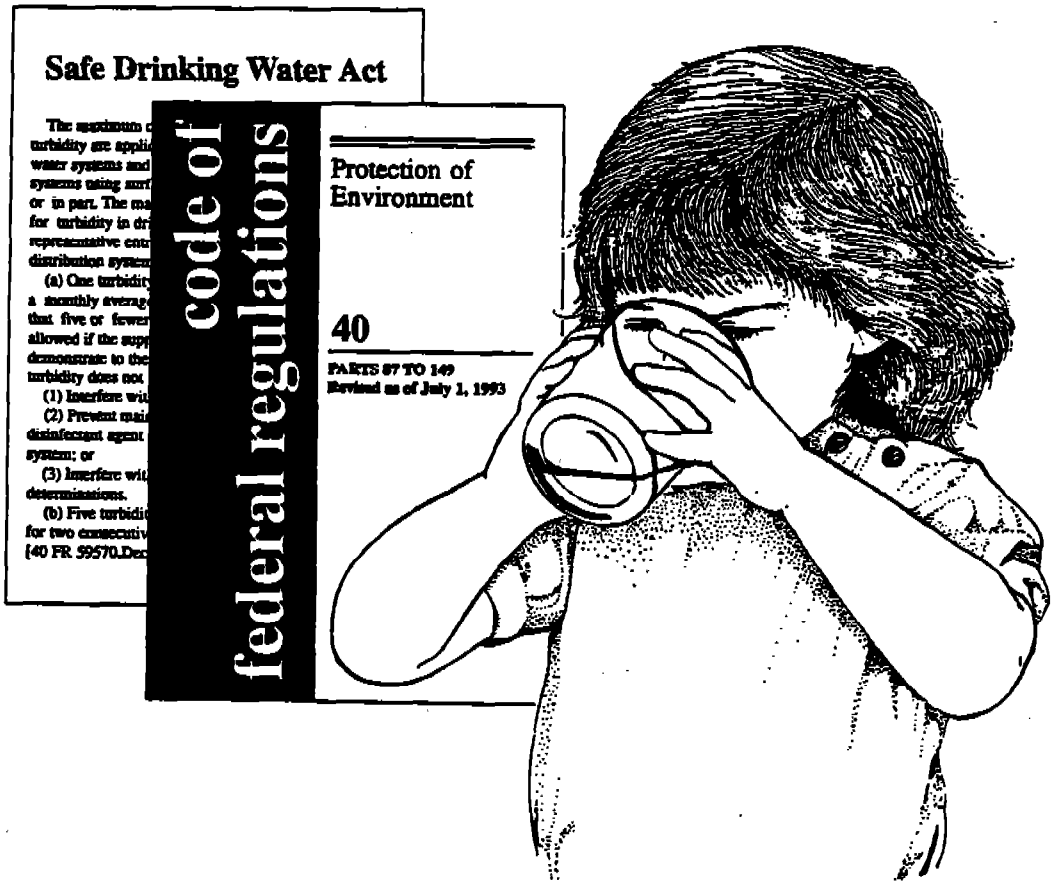
U.S. Army Center for Health Promotion and Preventive Medicine

Guidance For Providing Safe Drinking Water at Army Installations

(USACHPPM TECHNICAL GUIDE NO. 179)



U.S. Army Center for Health Promotion and Preventive Medicine

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USACHPPM

Readiness Thru Health

U.S. Army Center for Health Promotion and Preventive Medicine

The lineage of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) can be traced back over 50 years. This organization began as the U.S. Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of the Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of three thousand dollars.

Most recently, it became internationally known as the U.S. Army Environmental Hygiene Agency (AEHA). Its mission expanded to support worldwide preventive medicine programs of the Army, DOD, and other Federal agencies as directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.

On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission of providing preventive medicine and health promotion leadership, direction, and services for America's Army.

The organization's quest has always been one of excellence and the provision of quality service. Today, its goal is to be an established world-class center of excellence for achieving and maintaining a fit, healthy, and ready force. To achieve that end, the CHPPM holds firmly to its values which are steeped in rich military heritage:

- ★ *Integrity is the foundation*
- ★ *Excellence is the standard*
- ★ *Customer satisfaction is the focus*
- ★ *Its people are the most valued resource*
- ★ *Continuous quality improvement is the pathway*

This organization stands on the threshold of even greater challenges and responsibilities. It has been reorganized and reengineered to support the Army of the future. The CHPPM now has three direct support activities located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fitzsimons Army Medical Center, Aurora, Colorado; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of CHPPM's increasing global mission. As CHPPM moves into the 21st Century, new programs relating to fitness, health promotion, wellness, and disease surveillance are being added. As always, CHPPM stands firm in its commitment to Army readiness. It is an organization proud of its fine history, yet equally excited about its challenging future.

GUIDANCE FOR PROVIDING SAFE DRINKING WATER AT ARMY INSTALLATIONS

(USACHPPM TECHNICAL GUIDE NO. 179)

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GUIDANCE FOR PROVIDING SAFE DRINKING WATER AT ARMY INSTALLATIONS

(USACHPPM TECHNICAL GUIDE NO. 179)

CHAPTER 1
INTRODUCTION

1-1. Purpose

The purpose of this technical guide (TG) is to provide U.S. Army installations with guidance on meeting the requirements pursuant to the Safe Drinking Water Act (SDWA) with amendments of 1986 and 1988. Compliance with this law is essential to providing drinking water that is protective of consumer health. Army Regulation (AR) 200-1, Environmental Protection and Enhancement, and AR 420-46, Water Supply and Wastewater, require all Continental United States (CONUS) Army installations to provide drinking water in compliance with the SDWA and all applicable State and local regulations. All Outside Continental United States (OCONUS) Army installations must comply with the most strict standards of either the SDWA as written in the Overseas Environmental Baseline Guidance Document (OEBGD), the host nation, or the Status of Forces Agreement (SOFA).

1-2. References

Appendix A contains a list of references arranged according to subject matter. Copies of U.S. Environmental Protection Agency (EPA) documents can be received by contacting the Safe Drinking Water Hotline at 1-800-426-4791.

1-3. Abbreviations and Terms

The glossary contains the abbreviations and definitions of key terms used in this TG.

> Use of trademarked names does not imply endorsement by the U.S. Army but is intended only to assist in identification of a specific product.

1-4. Further Compliance Assistance

a. *CONUS Installations*. In addition to the guidance in this TG, CONUS installations can contact their State or Regional EPA offices for implementation guidance that is specific to their installation. Appendix B contains a list of primacy State points of contact for drinking water issues.

b. *OCONUS Installations*. Military OCONUS installations can receive technical and compliance support from U.S. Army Pacific Environmental Health Engineering Agency (USAPACEHEA) at DSN 228-4831 (for installations in Japan and other Far East countries), or the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM)-Europe at DSN 486-8556 (for installations in Germany and other European countries). Executive agents can also provide additional guidance on host nation water supply and treatment requirements that may be more stringent, or on a SOFA that may affect drinking water requirements. The OEBGD provides implementation guidance, procedures, and criteria for environmental compliance at Department of Defense (DOD) OCONUS installations. The document also outlines basic requirements for the provision of drinking water.

1-5. Technical Assistance

Additional assistance regarding drinking water issues may be obtained from the Water Supply Management Program of the USACHPPM at DSN 584-3919 or commercial (410) 671-3919. Environmental compliance assistance may be obtained by contacting the U.S. Army Environmental Center's (USAEC) Army Environmental Hotline at 1-800-USA-3845.

CHAPTER 2
BACKGROUND

2-1. History

a. *Pre-SDWA.* Before 1974, the United States did not have enforceable national drinking water standards. Each State had its own various standards, many of which were based upon the 1914 U.S. Public Health Service (PHS) standards. These standards governed the quality of drinking water on interstate carriers and were limited to the bacteriological quality of water until their fourth revision in 1962. This revision set limits for health-related chemical and biological contaminants as well as impurities which affected the appearance, taste, and odor of drinking water. Independent studies by the PHS and the EPA in 1969 revealed that almost half of the water systems surveyed did not provide drinking water that met the PHS standards of 1962. As a result of this study and increasing public awareness of the quality of drinking water, Congress developed legislation making all public drinking water supplies subject to the authority of the EPA. This legislation was called the SDWA, Public Law (PL) 93-523, and was signed on December 16, 1974.

b. *SDWA.* The SDWA of 1974 was the legislation that gave the EPA its authority to regulate public water supplies. The SDWA required the EPA to publish drinking water regulations to improve drinking water quality throughout the United States. The SDWA was amended in 1977, 1979, and 1980 for procedural changes. In response to the public's growing health concerns over drinking water, Congress significantly changed the SDWA through the SDWA Amendments of 1986.

c. *SDWA Amendments of 1986.* The SDWA Amendments of 1986 arose from continued public concern about unregulated contaminants found in drinking water and contamination of ground water by industrial solvents and pesticides. Concerns included pathogens that were not regulated in the 1974 SDWA, widespread contamination of shallow ground water, lead in plumbing materials, radon, poor definitions of treatment techniques to remove contaminants, and changes in public notification needs. The SDWA Amendments of 1986, signed as PL 99-339 on June 19, 1986, addressed these concerns and documented the improved analytical techniques available for contaminant detection.

2-2. Applicability

The SDWA authorized the EPA to conduct studies, set contaminant limits based upon those studies, and oversee implementation of the new regulations. These regulations apply to all public water systems (PWSs). A PWS is defined as a system serving water to an area with at least 15 service connections or regularly serving 25 people daily at least 60 days per year.

2-3. Standards

The SDWA required the EPA to determine what constitutes "safe" drinking water by establishing Federal standards. These standards are in the form of Maximum Contaminant Level Goals (MCLGs), Maximum Contaminant Levels (MCLs), Action Levels (ALs), or treatment techniques for removing the contaminants. The first 23 standards set between 1974 and 1986 were the National Interim Primary Drinking Water Regulations (NIPDWR). These standards were based upon the 1962 PHS standards and studies conducted by the National Academy of Sciences. The SDWA Amendments of 1986 eliminated the term "Interim" from the title, and the regulations became known as the National Primary Drinking Water Regulations (NPDWR). The NPDWR are reflected in Title 40, Code of Federal Regulations (CFR), Part 141. In addition, the 1986 amendments required the EPA to establish Secondary MCLs (SMCLs) for those contaminants that affect the aesthetic quality of drinking water. These SMCLs comprised the National Secondary Drinking Water Regulations (NSDWR) and are reflected in 40 CFR 143.

2-4. Implementation and Primacy

In order to effectively implement the SDWA, the EPA expected State governments and health authorities to accept most of the responsibility for administering and enforcing the drinking water regulations. Through a program of "primacy," each State, or other designated agent, must adopt its own set of drinking water standards that are at least as stringent as the Federal standards. Currently (as of June 1995), all states and the seven U.S. territories governed by the SDWA (the District of Columbia, Puerto Rico, the Virgin Islands, American Samoa, Guam, the Commonwealth of Northern Mariana Islands, and the Republic of Palau) have primacy except Wyoming and Washington D.C. In addition, Indian tribes are authorized under the SDWA to retain primacy for their own drinking water programs, if the EPA determines that the tribe is capable of accomplishing the required primacy tasks. Throughout the remainder of this TG, primacy agencies shall be referred to as "States."

2-5. Enforcement

States have the enforcement responsibility to ensure compliance with the SDWA. If a State does not take appropriate action regarding compliance with the SDWA, the EPA can take enforcement actions against a PWS. The EPA will first issue a violation notice to both the violator and the State, and may provide advice and technical assistance on what steps can be taken to bring the system into compliance. If the State does not act within 30 days, the EPA can issue the PWS an administrative order, with civil penalties up to $25,000 per day per violation. A total penalty of $5,000 or less can be assessed without going to a district court.

2-6. Expanding Regulatory Program

The SDWA Amendments of 1986 significantly strengthened the Federal role in regulating drinking water quality. The most imposing change was a mandate for establishing a growing set of water quality-related regulations. The mandate required the EPA to issue new or revised MCLs and MCLGs for 83 contaminants by the end of 1989. Thereafter, the EPA is required to regulate 25 contaminants every 3 years. In order to do this effectively, the EPA comprised a list of known and potential drinking water contaminants, the Drinking Water Priority List (DWPL). The DWPL is to be updated every 3 years, as new contaminants are discovered or deleted.

2-7. Ground-Water Protection Programs

The SDWA and SDWA Amendments of 1986 contain provisions for three ground-water protection programs. The purpose of these programs is to prevent contamination of ground water used as a source of drinking water.

a. *Sole Source Aquifer Demonstration (SSAD) Program - 40 CFR 149.* The 1986 SDWA Amendments established the SSAD program to ensure that critical aquifer protection areas (CAPAs) are not adversely impacted by Federal, State or local activities. A CAPA is either all or part of a major recharge area of a sole or principal drinking water source aquifer. The program requires the development of a comprehensive management plan which identifies potential sources of ground-water degradation, impact of land use, and proposed actions to prevent adverse impacts.

b. *Wellhead Protection (WHP) Program - PL 99-339, Section 205.* The SDWA Amendments of 1986 established the WHP program to protect the recharge area of public water supply wells from all sources of contamination. States were given the responsibility of developing their own WHP programs. A WHP program requires systems using ground water to delineate the drinking water well's or well field's Wellhead Protection Area (WHPA). The WHPA is the surface and subsurface area surrounding the water well or well field, through which contaminants are reasonably likely to move toward and reach the water well or well field. The program also regulates all activities within this WHPA. Appendix A contains a variety of references with further information on the WHP program.

c. *Underground Injection Control (UIC) Program - 40 CFR 144-148.* The SDWA established the UIC program to protect ground water from materials disposed of through underground injection wells. Each State is responsible for developing and implementing its own UIC program. Basically, the program prohibits and penalizes all underground injections unless authorized by a permit. Permitted underground injection operations must be monitored to determine the effects, if any, on nearby ground water.

d. *Compliance with Ground-Water Protection Programs.* Army installations using a ground-water source should contact the State to determine specific WHP program or SSAD program requirements. Some installations may not have ground-water systems, but may be located within another system's WHPA or CAPA and must comply with the regulations on activities within that area. Army installations involved in underground injection operations of any type of material should contact the State to ensure compliance with applicable UIC regulations.

2-8. Lead Contamination Control Act

a. *Health Effects of Lead.* Lead can pose a significant risk to human health if too much of it enters the body. The greatest risk is to young children (especially under the age of 6) and the fetuses of pregnant women, since they absorb lead more easily. Lead entering a child's bloodstream can build up and slow down normal mental and physical development. This results in deficits in IQ and other measures of cognitive function, such as attention span. For pregnant women and their fetuses, lead has been known to cause low birth weights and decreased gestation periods. Most health risks are associated with blood lead levels above 10 μg/dL, but some health effects have been seen at lower blood lead levels. Small increases in blood pressure have been seen in adults with blood lead levels as low as 6 μg/dL. The EPA estimates that drinking water can make up to 20 percent of a person's exposure to lead, and thus included drinking water in their programs and regulations to decrease the occurrence of lead in the environment. Two regulations that address lead in drinking water are the Lead Contamination Control Act, discussed below, and the Lead and Copper Rule, discussed in paragraph 4-7.

b. *Lead Contamination Control Act (LCCA)- PL 100-572.* The LCCA was passed as an amendment to the SDWA on October 31, 1988. It was designed to minimize children's exposure to lead from drinking water at schools and day care centers. One of the major provisions of the LCCA required the EPA to produce a list of drinking water coolers that are not lead free. This list was published in the Federal Register (FR) on April 10, 1989 (54 FR 14320) and updated on January 18, 1990 (55 FR 1772). The Consumer Product Safety Commission then negotiated consent agreements with manufacturers concerning the recall and replacement of non-lead free coolers. The LCCA also required States to produce a guidance document and testing protocol to assist schools in determining the source and degree of lead contamination in school drinking water supplies and in remedying such contamination. This guidance document along with the list of non-lead-free coolers was to be disseminated to all local education agencies, private nonprofit elementary or secondary schools and day care centers. The EPA created a guidance document entitled "Lead in School Drinking Water -

A Manual for School Officials to Detect, Reduce, or Eliminate Lead in School Drinking Water." All U.S. Army installations should inventory existing drinking water coolers and replace those listed as non-lead free, if they have not already done so. Installation lead reduction programs should include facility day care centers and schools.

2-9. Other Provisions

Other provisions of the SDWA Amendments of 1986 include, but are not limited to the following:

a. Required monitoring for unregulated contaminants to form a database for the EPA's expandable DWPL (see paragraph 4-8a).

b. A ban on the use of harmful lead-containing materials for plumbing supplies.

c. Requirements for public notification (see Chapter 7).

d. Requirements for the EPA to select and publish approved treatment methods for removal of each regulated contaminant.

2-10. Regulations Applicable to Army Installations

Congress has waived Federal sovereign immunity to State and local requirements concerning the SDWA. Section 1447 of the SDWA states, "Each federal agency having jurisdiction over any federally owned or maintained public water system...shall be subject to, and comply with, all federal, State, and local requirements, administrative authorities, and process and sanctions respecting the provision of safe drinking water...and to the same extent as any non-governmental entity." Therefore, **U.S. Army installations are responsible for complying with all applicable Federal, State, and local drinking water regulations.** Typical State and local regulations include operation and maintenance (O&M) practices, design criteria, permit requirements (e.g., water withdrawal), and operator certification. In the case of installations located within an area or State without primacy, the installation must comply with Federal drinking water regulations. Army policy (AR 200-1) requires OCONUS installations to comply with host nation regulations, Federal drinking water regulations as outlined in the OEBGD, or regulations in a SOFA, whichever are most stringent. Army regulations pertaining to the provision of drinking water apply to all Army installations. They are found in AR 200-1 (Environmental Protection and Enhancement), AR 420-46 (Water Supply and Wastewater) and AR 40-5 (Preventive Medicine). These regulations refer to guidance and procedures outlined in TB MED 576 (Sanitary Control and

Surveillance of Water Supplies at Fixed Installations), TB MED 577 (Sanitary Control and Surveillance of Field Water Supplies), the TM 5-813 series, TM 5-660 (Maintenance of Water Supply, Treatment and Distribution Systems), and TM 5-810-5 (Plumbing).

CHAPTER 3
MEETING THE REQUIREMENTS

3-1. Water Systems Not Covered by the Safe Drinking Water Act

U.S. Army installations meeting all of the following criteria are **not** required to comply with the SDWA, since they do not qualify as a PWS:

a. Contains a drinking water system consisting only of distribution and storage facilities (i.e., provides no treatment, including no re-chlorination or fluoridation, anywhere in system).

b. Obtains all of its drinking water from a regulated water supplier.

c. Does not sell its drinking water.

d. Does not provide water to commercial carriers conveying passengers in interstate commerce.

For example, if an installation receives its potable water from a neighboring town, provides no extra treatment of the water, and does not charge customers for the distributed water, the installation is exempt from compliance with Federal drinking water regulations. However, some State or local drinking water regulations may still apply, and Army drinking water regulations do apply.

3-2. System Classifications

Public water systems are divided into two major categories: community water systems (CWSs) and non-community water systems (NCWSs). A CWS supplies water to year-round residents. An NCWS is used by travelers or intermittent consumers. All NCWSs are further divided into two categories: transient, non-community (TNC) systems and non-transient, non-community (NTNC) systems. An example of a TNC system is a hospital or a hotel that has its own drinking water supply. The NTNC systems include schools or work places with their own drinking water systems; they provide water for the same people throughout the year, but for less than 24 hours a day (e.g., an 8-hour work day or a 6-hour school day). The SDWA regulations apply to these different systems with different intensities, since consumer exposure to potential contaminants varies among the system types. The TNC systems only have to comply with those regulations that govern contaminants which may result in acute health effects (such as microbiologicals and nitrate/nitrite), rather than health effects associated with long-term exposure (such as organic carcinogens). The NTNC

systems have to comply with all regulations that apply to CWSs with the exception of monitoring for total trihalomethanes. It is important to determine the classification of an installation's water system(s) to assess applicable requirements of the SDWA. [NOTE: As a rule of thumb, if the installation's water supply qualifies as a PWS (see paragraph 2-2) and the installation has housing areas, the water supply is a CWS.] The State should be contacted to verify exact classification. Figure 3-1 provides a flowchart to aid in the determination of a water system's classification.

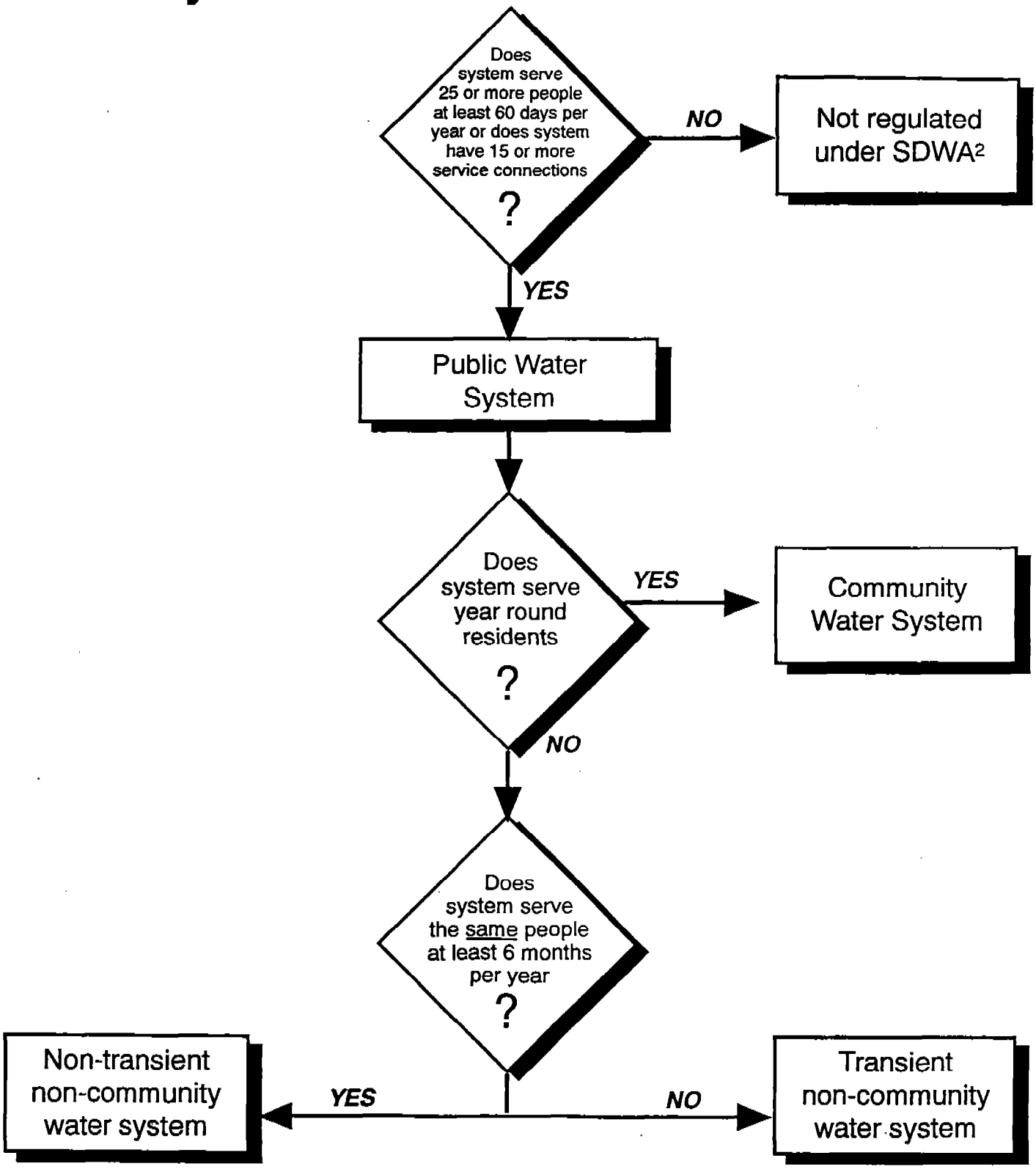
3-3. Population Served

Many of the monitoring requirements and the effective dates of standards are dependent upon the size of the system. The term "size" refers to the number of people served, rather than the production capacity of the water treatment facility. Populations on Army installations consist of both resident and non-resident personnel and often fluctuate due to military mission requirements. If the population served is unclear, the State should be contacted to determine the applicable monitoring requirements and effective dates of standards.

3-4. Water Quality Standards

Compliance with the water quality standards of the SDWA, reflected in the NPDWR (and NSDWR, if enforced by the State), is determined in one of two ways: application of a required treatment technique to control or remove regulated contaminants, or maintenance of water quality meeting all drinking water MCLs and ALs (or SMCLs). The MCL for a regulated contaminant is a Federally enforceable standard. (ALs are defined in paragraph 4-7, Lead and Copper Rule.) The EPA establishes each MCL based upon the contaminant's MCLG -- the level of a contaminant in drinking water at which no known or anticipated adverse health effects are expected to occur. The MCLGs are not Federally enforceable but are a more desirable limit. Before establishing an MCL, the EPA considers the best available technologies (BATs) for removing the contaminant, analytical technologies for monitoring the contaminant, and the cost associated with both. A balance must be made between the cost to the consumer and the reduction of the risk to consumer health. This cost-benefit analysis attempts to achieve a risk to human health that is no greater than one in a million (i.e., the added threat of the contaminant at that level would cause no more than one extra cancer/adverse health effect per million people, each drinking 2 liters of water per day during a 70-year lifetime).

Water System Classification Flowchart [1,3]



(1) In accordance with Federal laws. State & local laws may be more stringent.
(2) Local board of health may require initial bacteriological and nitrate analyses.
(3) Does not address issue of consecutive water systems which is determined independently by each state.

Figure 3-1.

3-5. Phases of Regulations

a. The MCLs and MCLGs for contaminants are set according to a regulatory agenda established by the EPA immediately following the SDWA Amendments of 1986. The EPA categorized the 83 compounds to be regulated by 1989 and chose to regulate the groups in stages. Microbiological contaminants are regulated under the Total Coliform Rule and the Surface Water Treatment Rule. The remainder of the groups of contaminants are regulated under the Phase I, II and V rules (with the exception of fluoride and lead and copper). Future regulations for contaminants from the DWPL and from the remaining original 83 compounds (see paragraph 2-6) will be regulated in phases as well. Appendix C contains the current list of regulated contaminants and Appendix D contains the latest regulatory schedule, as of October 95, for the anticipated phases.

b. Phase I regulated 8 volatile organic chemicals (VOCs) and also required systems to monitor for up to 51 unregulated organic contaminants. Phase II regulated 38 organic and inorganic contaminants, several of which came from the Phase I unregulated monitoring list. Phase II also required unregulated contaminant monitoring. Phase V regulated 23 organic and inorganic chemicals. Many of the Phase V contaminants were a part of either Phase I or Phase II unregulated monitoring. This building-block scheme was meant to ease the monitoring complexity by regulating contaminants for which a system has already been monitoring.

3-6. Standardized Monitoring - 56 FR 3526

a. *Purpose*. Drinking water produced must be monitored to ensure that it meets all applicable MCLs. The EPA created a Standardized Monitoring Framework to reduce the variability and complexity of drinking water monitoring requirements. The framework synchronizes the monitoring schedules for source-related contaminants associated with chronic health effects (i.e., VOCs, pesticides, herbicides, radionuclides, and inorganics other than nitrate/nitrite).

b. *The Standardized Monitoring Framework.* The framework consists of a 9-year (based on a calendar year) compliance cycle which is comprised of three 3-year compliance periods (see Figure 3-2). The first 9-year compliance cycle began on January 1, 1993 and ends on December 31, 2001. The first 3-year compliance period includes 1993, 1994 and 1995. The framework provides States the flexibility to determine the specific year within a compliance period that water systems must conduct monitoring activities. States may wish to prioritize sampling based upon system size, vulnerability, or laboratory capacity. Once a system is scheduled to sample in the first, second or third year within a 3-year compliance period, the system must then sample in the corresponding year of subsequent compliance periods.

THE COMPLIANCE CALENDAR

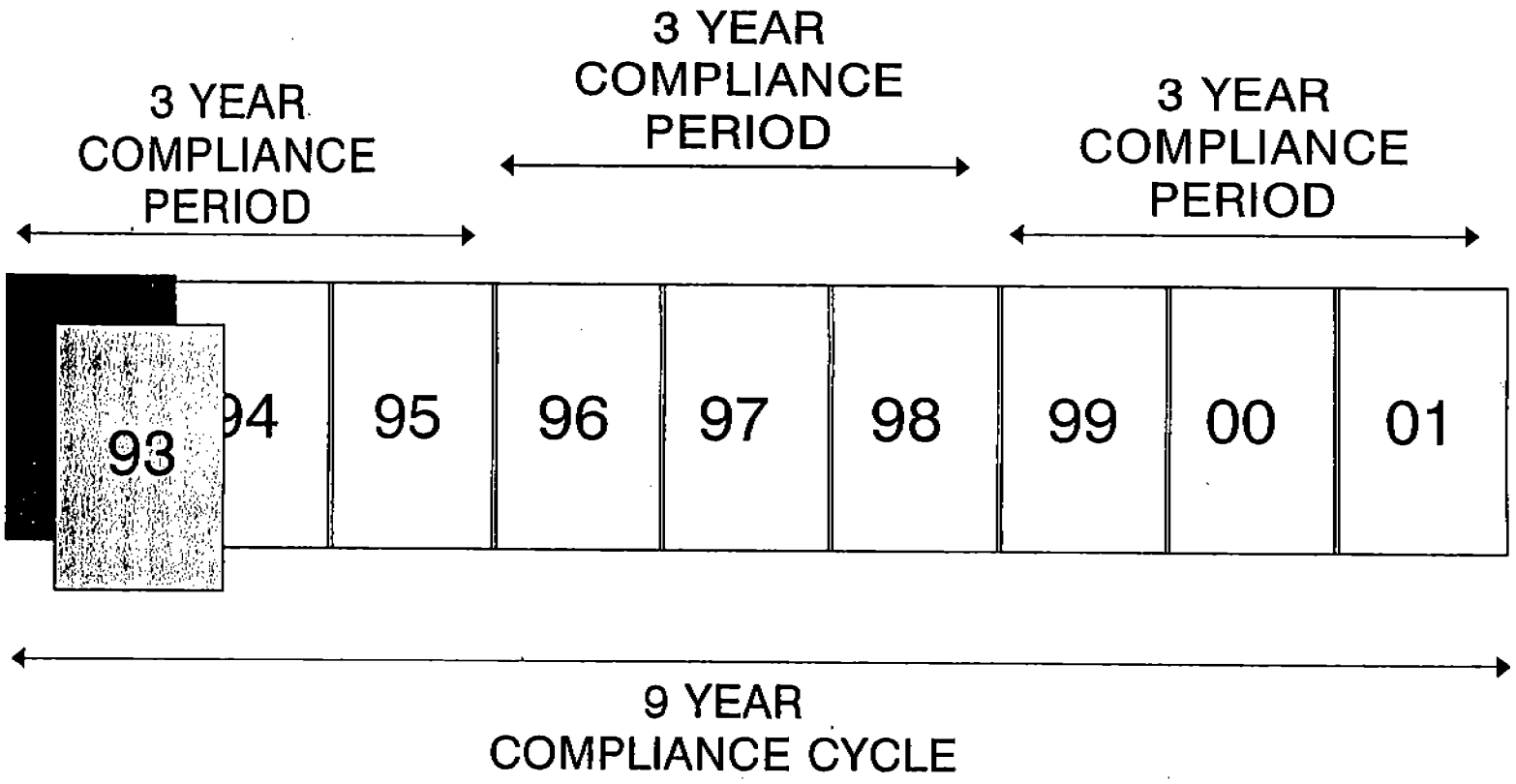


Figure 3-2.

c. *Specific Standardized Monitoring Requirements.*

(1) Each new set of regulations has initial sampling requirements that must be completed by all systems. The initial round of monitoring is required in the first full 3-year compliance period after the effective date of a regulation. For example, if a regulation is effective sometime in 1994, then initial monitoring must occur within 1996-1998.

(2) Systems that complete initial monitoring may be eligible to reduce monitoring frequency to the base or minimum sampling frequency. All systems must sample at this repeat frequency, unless they receive a waiver from the State.

(3) Systems that detect contamination, either during initial or repeat monitoring, must sample quarterly at each sampling point detecting contamination. The concentration that constitutes "detection" is defined as the MCL for inorganics, 0.0005 mg/L for VOCs, or at the Method Detection Limit (MDL) for pesticides/herbicides, polychlorinated biphenyls (PCBs), and synthetic organic chemicals (SOCs). Quarterly sampling must continue until the State determines that the analytical results are "reliably and dependably" below the MCL. Ground-water systems must take a minimum of 2 quarterly samples before this decision can be made, and surface water systems must take 4 quarterly samples.

(4) Waivers are available to all systems based upon the results of a State conducted or approved vulnerability assessment (see paragraph 3-7). Waivers can either reduce sampling frequencies (VOCs and inorganics) or eliminate any sampling (pesticides, asbestos, and unregulated contaminants). Waivers based upon vulnerability assessments are good for 3 years for pesticides, 6 years for VOCs, and 9 years for inorganics. A new vulnerability assessment must be performed in order to renew a waiver. Minimum criteria for the assessments are published in each regulation.

(5) The Standardized Monitoring Framework allows for the grandfathering of monitoring data at the State's discretion. Data collected up to 3 years prior to the beginning of the 3-year compliance period, in which initial monitoring is to begin, can be used to satisfy initial monitoring requirements. Systems grandfathering data would then monitor at the base monitoring frequencies unless issued a waiver.

3-7. Vulnerability Assessments

Monitoring for organics and inorganics under the Standardized Monitoring Framework is subject to modifications depending upon a system's vulnerability to contamination. States with primacy that have developed vulnerability assessment protocols, may allow systems to

conduct the assessments to apply for a waiver. The waiver can eliminate initial monitoring requirements or can significantly reduce monitoring frequencies after initial monitoring is completed. The goal of the vulnerability assessment program is to reduce the overall implementation costs of the regulations. The EPA deemed it most appropriate to allow the States to identify site-specific needs to develop their own assessment protocol based upon federal guidelines. Examples of considerations for a vulnerability assessment include previous analytical results, proximity of the system to sources of contamination, environmental persistence of the contaminant, protection of the water source, proximity to commercial or industrial use, and use profile of the contaminant within the area. If a State chooses not to develop an assessment protocol, systems cannot receive waivers and must monitor at the base frequency.

3-8. Variances and Exemptions

The SDWA permits States to grant a variance or exemption to a PWS from an MCL if the State finds that doing so will not result in an unreasonable risk to health of the consumers (see paragraph 11-2). A variance is issued to a system when source water conditions prohibit a system from meeting an MCL, even with BAT application. A schedule for compliance with incremental progress toward achieving the MCL is issued at the same time the variance is issued. An exemption is granted to a PWS unable to comply with an MCL or treatment technique due to economic constraints. An exemption is granted for 1 year with the possibility for extending the reprieve for 2 additional years. Systems with 500 or less service connections may renew an exemption for one or more 2-year periods upon demonstration of pursuit of all practicable steps toward compliance. Not all regulations allow for variances and/or exemptions.

3-9. Analytical Requirements

All regulated drinking water analyses must be conducted by State certified laboratories. All certified laboratories must conduct analyses using approved test methodologies. Federally approved methodologies are listed in Title 40, CFR, Parts 141 (NPDWR) and 143 (NSDWR).

CHAPTER 4
NATIONAL PRIMARY DRINKING WATER REGULATIONS CONTAMINANTS AND STANDARDS

4-1. Inorganic Contaminants

a. *Applicability*. Inorganic standards, with the exception of the fluoride standard, apply to CWSs and NTNC water systems. Only CWS must comply with the fluoride MCL. Nitrate/nitrite requirements apply to all PWSs, including TNC systems.

b. *Standards*. The majority of inorganic contaminants are regulated under the Phase II and V rules. Arsenic is the only remaining original inorganic NIPDWR contaminant of 1974; the EPA has reexamined the other inorganics regulated in 1974 and given them new or reaffirmed original MCLs. The EPA is in the process of updating the arsenic MCL and is considering a new MCL between 0.002 to 0.020 mg/L. Fluoride was regulated alone as Phase IA. Inorganic contaminant MCLs and their effective dates are found in Table 4-1. Lead and copper are regulated under the Lead and Copper Rule, reflected in Title 40, CFR, Part 141, as Subpart I, "Control of Lead and Copper." This rule is discussed separately in paragraph 4-7.

TABLE 4-1. INORGANIC MCLs AND EFFECTIVE DATES

Contaminant	MCL (mg/L)	MCLG (mg/L)	Effective Date
Arsenic	0.05	–	NIPDWR
Fluoride	4.0	4.0	October 2, 1987
Asbestos	7 MF/L*	7 MF/L	Phase II, Jul 30, 1992
Barium	2	2	Phase II, Jul 30, 1992
Cadmium	0.005	0.005	Phase II, Jul 30, 1992
Chromium	0.1	0.1	Phase II, Jul 30, 1992
Mercury	0.002	0.002	Phase II, Jul 30, 1992
Nitrate (as N)	10+	10	Phase II, Jul 30, 1992
Nitrate (as N)	1+	1	Phase II, Jul 30, 1992
Selenium	0.05	0.05	Phase II, Jul 30, 1992
Antimony	0.006	0.006	Phase V, Jan 17, 1994
Beryllium	0.004	0.004	Phase V, Jan 17, 1994
Cyanide	0.2	0.2	Phave V, Jan 17, 1994
Nickel	0.1	0.1	Phave V, Jan 17, 1994
Thallium	0.002	0.0005	Phave V, Jan 17, 1994

* MF/L - million fibers per liter, fiber size longer than 10 microns.
\+ The MCL for total Nitrate/Nitrite as N is 10 mg/L.

c. *Monitoring.*

(1) Monitoring requirements are presented in Figures 4-1 through 4-4. Base requirements vary with source water: surface water systems must sample annually, and ground-water systems must sample every 3 years. One sample is required for each entry point to the distribution system.

(2) Initial monitoring for Phase II inorganics must occur within the first 3-year compliance period which began in January 1993. Systems with 150 or more service connections should also monitor for Phase V contaminants during the first compliance period. Systems with less than 150 service connections will begin monitoring for Phase V inorganics in the second 3-year compliance period, beginning in January 1996.

(3) Cyanide monitoring is required for only those systems determined to be vulnerable (e.g., those systems using sources near industrial and manufacturing operations). Systems may apply to the State for a waiver to avoid monitoring for asbestos if it can demonstrate that it is not vulnerable to asbestos contamination. Vulnerability for asbestos contamination is determined based upon potential for asbestos contamination of the source water and the use of asbestos-cement pipe for finished water distribution and the corrosive nature of the water. Arsenic and fluoride are monitored annually for surface water systems and every 3 years for ground-water systems. (Note: Systems that fluoridate the drinking water must monitor for fluoride at least daily, in accordance with TB MED 576.)

(4) Reduced monitoring programs and waivers are available at the State's discretion.

d. *Compliance Determination.* For systems required to monitor more frequently than annually, compliance with the MCL is based upon a running annual average (RAA). For systems monitoring annually or less frequently, the system is out of compliance if any sample exceeds the MCL. No system may exceed Nitrate/Nitrite MCLs in any sample taken to remain in compliance.

e. *BATs.* Appendix E contains a list of the BATs for removal of regulated inorganics.

Inorganic Monitoring Flowchart

Source: Summary of Phase II Regulations, EPA Doc. No. 570/9-91-022, October 1991.

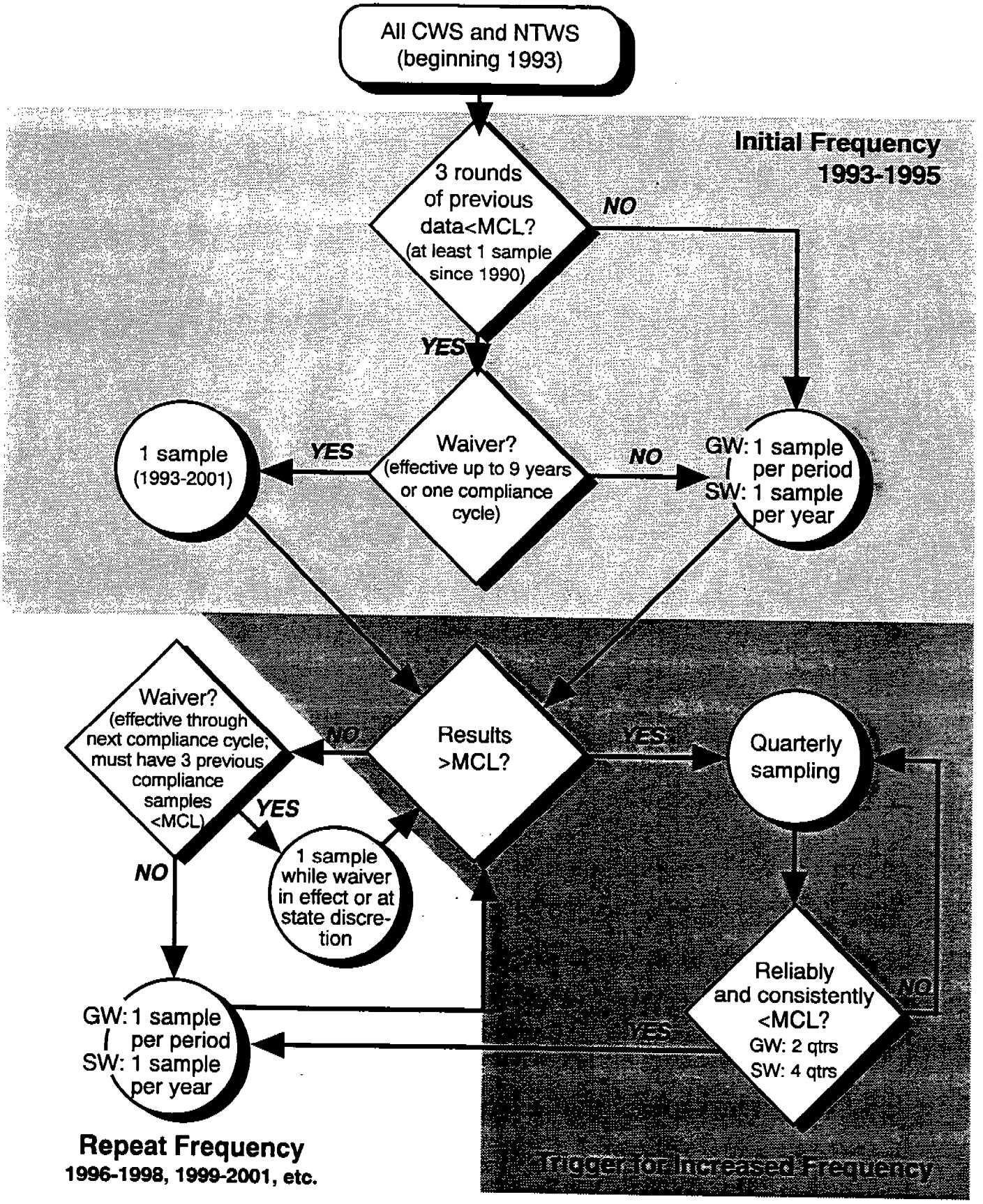


Figure 4-1.

Asbestos Monitoring Flowchart

Source: Summary of Phase II Regulations, EPA Doc. No. 570/9-91-022, October 1991.

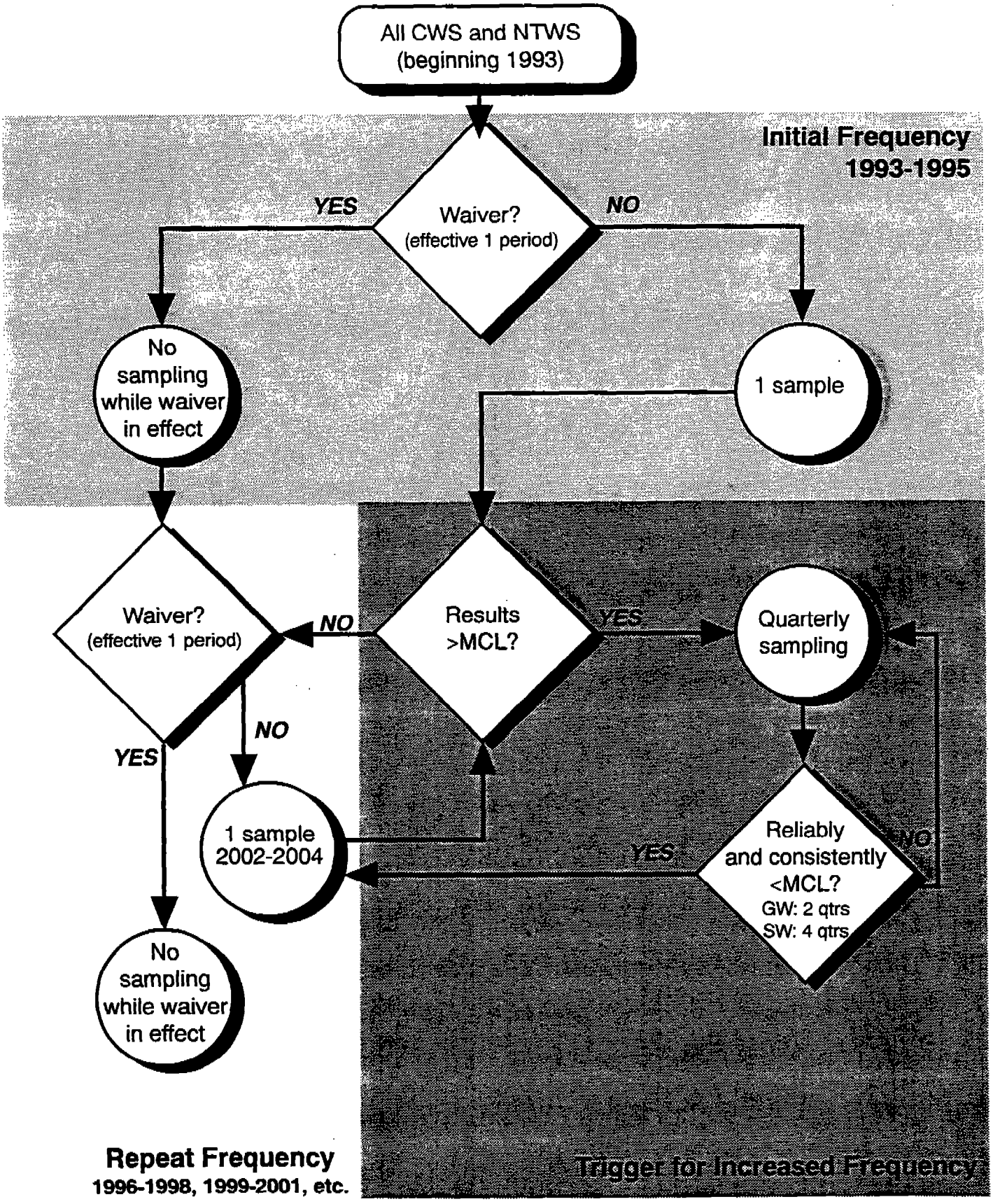


Figure 4-2.

Nitrate Monitoring Flowchart

Source: Summary of Phase II Regulations, EPA Doc. No. 570/9-91-022, October 1991.

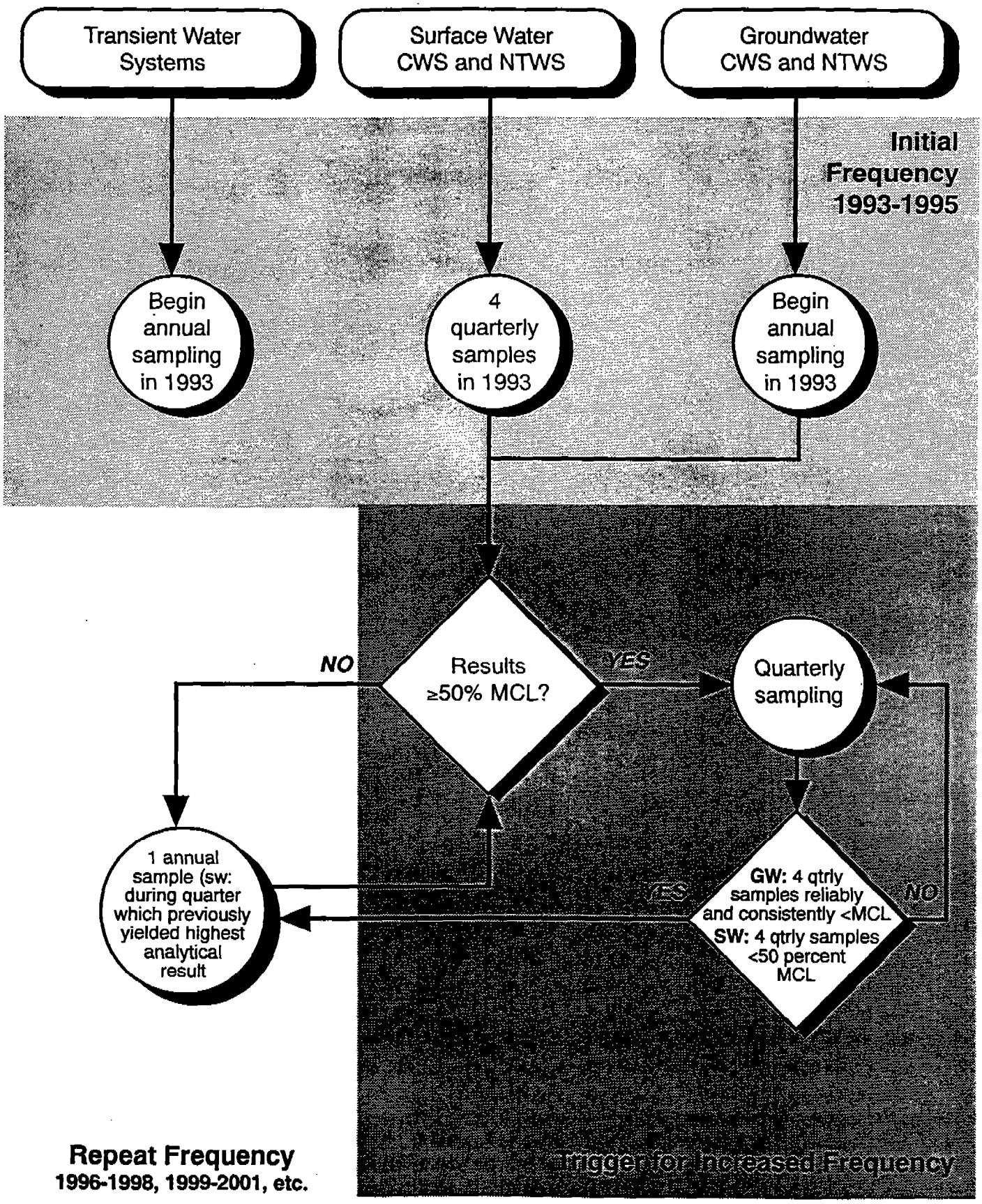
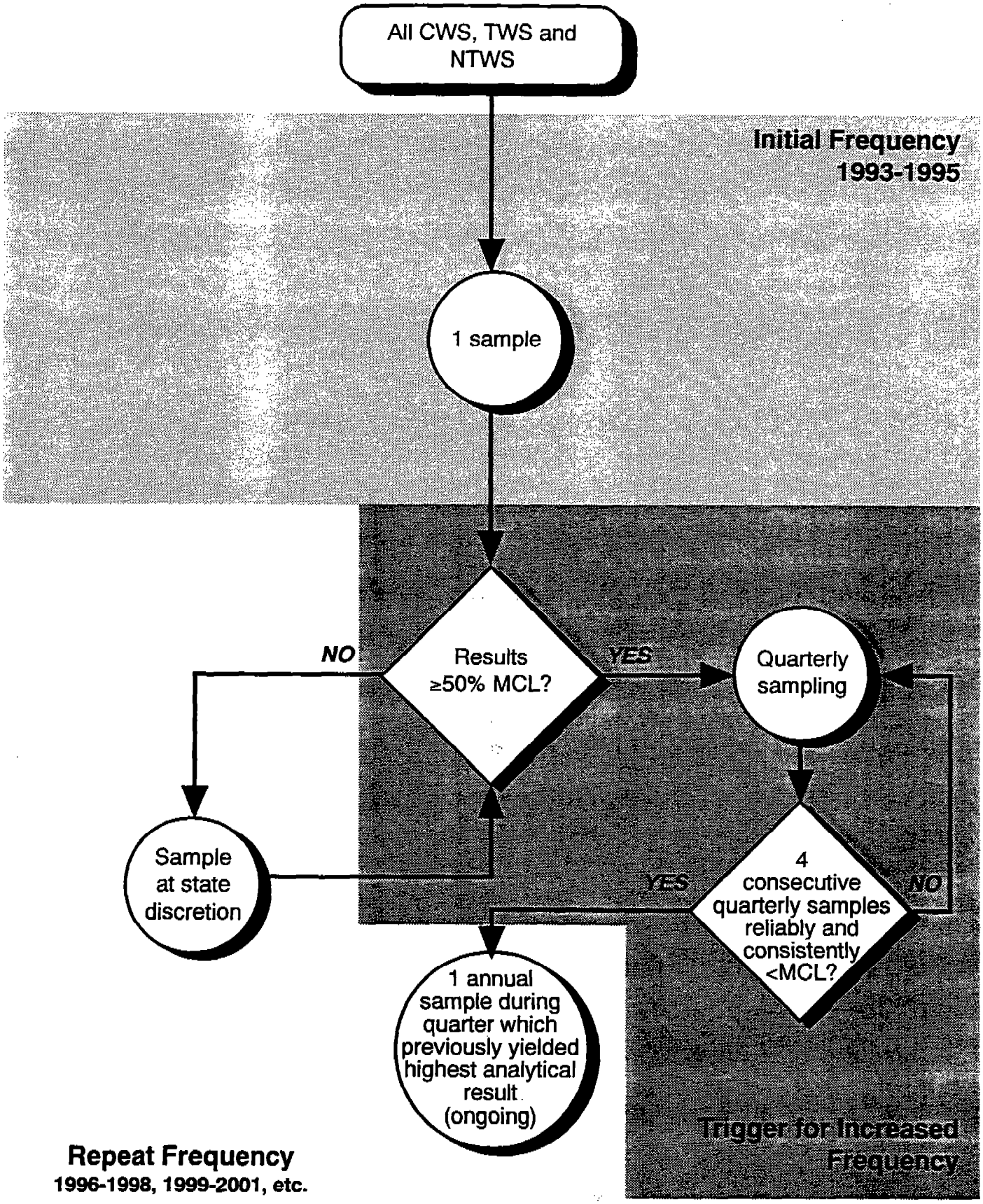


Figure 4-3.

Nitrite Monitoring Flowchart

Source: Summary of Phase II Regulations, EPA Doc. No. 570/9-91-022, October 1991.



igure 4-4.

4-2. Organic Contaminants

a. *Applicability*. Organic standards apply to CWSs and NTNC water systems. The current NPDWR standard for total trihalomethanes (TTHMs) applies only to CWSs serving at least 10,000 people.

b. *Standards*. The NPDWR regulated 7 organic contaminants. Phases I, II and V added 47 more organics to the list of regulated contaminants, bringing the total to 54 regulated organics as of 1994. The proposed Disinfectants and Disinfection-By-Products (DDBP) Rule (Phase VIA) will set a new TTHM MCL and will regulate other organic contaminants associated with the disinfection of drinking water. Table 4-2 contains a list of the currently regulated organic contaminant MCLs and their effective dates.

TABLE 4-2. ORGANIC MCLs AND EFFECTIVE DATES

Contaminant	MCL	MCLG	Effective Date
Volatile Organics, mg/L			
Trihalomethanes	0.10	0.10	NIPDWR
Benzene	0.005	zero*	Phase I, Jan 9, 1989
Carbon tetrachloride	0.005	zero	Phase I, Jan 9, 1989
para-Dichlorobenzene	0.075	0.075	Phase I, Jan 9, 1989
1,2-Dichloroethane	0.005	zero	Phase I, Jan 9, 1989
1,1-Dichloroethylene	0.007	0.007	Phase I, Jan 9, 1989
Trichloroethylene	0.005	zero	Phase I, Jan 9, 1989
1,1,1-Trichloroehtane	0.20	0.20	Phase I, Jan 9, 1989
Vinyl chloride	0.002	zero	Phase I, Jan 9, 1989
o-Dichlorobenzene	0.6	0.6	Phase II, Jul 30, 1992
cis-1,2-Dichloroethylene	0.07	0.07	Phase II, Jul 30, 1992
trans-1,1-Dichloroethylene	0.1	0.1	Phase II, Jul 30, 1992
1,2-Dichloropropane	0.005	zero	Phase II, Jul 30, 1992
Ethylbenzene	0.7	0.7	Phase II, Jul 30, 1992
Monochlorobenzene	0.1	0.1	Phase II, Jul 30, 1992
Styrene	0.1, TT+	0.1	Phase II, Jul 30, 1992
Tetrachloroethylene	0.005	zero	Phase II, Jul 30, 1992
Toluene	1.0	1.0	Phase II, Jul 30, 1992
Xylenes (total)	10	10	Phase II, Jul 30, 1992
Dichloromethane	0.005	zero	Phase V, Jan 17, 1994
1,2,4-Trichlorobenzene	0.07	0.07	Phase V, Jan 17, 1994
1,1,2-Trichloroethane	0.005	0.003	Phase V, Jan 17, 1994
Synthetic Organics, mg/L			
Benzo(a)pyrene	0.0002	zero	Phase V, Jan 17, 1994
Di(2-ethylhexyl)adipate	0.4	0.4	Phase V, Jan 17, 1994
Di(2-ethylhexyl)phthalate	0.006	zero	Phase V, Jan 17, 1994
Hexachlorobenzene	0.001	zero	Phase V, Jan 17, 1994
Hexachlorocyclopentadiene	0.05	0.05	Phase V, Jan 17, 1994
2,3,7,8-TCDD (Dioxin)	3x10E(-8)	zero	Phase V, Jan 17, 1994
Pesticides/Herbicides, mg/L			
Alachlor	0.002	zero	Phase II, Jul 30, 1992
Atrazine	0.003	0.003	Phase II, Jul 30, 1992

Contaminant	MCL	MCLG	Effective Date(cont)
Pesticides/Herbicides, cont.			
Carbofuran	0.04	0.04	Phase II, Jul 30, 1992
Chlordane	0.002	zero	Phase II, Jul 30, 1992
2,4-D	0.07	0.07	Phase II, Jul 30, 1992
Dibromochloropropane (DBCP)	0.0002	zero	Phase II, Jul 30, 1992
Ethylene dibromide (EDB)	0.00005	zero	Phase II, Jul 30, 1992
Heptachlor epoxide	0.0002	zero	Phase II, Jul 30, 1992
Heptachlor	0.0004	zero	Phase II, Jul 30, 1992
Lindane	0.0002	0.00	Phase II, Jul 30, 1992
Methoxychlor	0.04	0.04	Phase II, Jul 30, 1992
PCBs	0.0005	zero	Phase II, Jul 30, 1992
Pentachlorophenol	0.001	zero	Phase II, Jul 30, 1992
2,4,5-TP (Silvex)	0.05	0.05	Phase II, Jul 30, 1992
Toxaphene	0.003	zero	Phase II, Jul 30, 1992
Dalapon	0.2	0.2	Phase V, Jan 17, 1994
Dinoseb	0.007	0.007	Phase V, Jan 17, 1994
Diquat	0.02	0.02	Phase V, Jan 17, 1994
Endothall	0.1	0.1	Phase V, Jan 17, 1994
Endrin	0.002	0.002	Phase V, Jan 17, 1994
Glyphosate	0.7	0.7	Phase V, Jan 17, 1994
Oxamyl (Vydate)	0.2	0.2	Phase V, Jan 17, 1994
Picloram	0.5	0.5	Phase V, Jan 17, 1994
Simazine	0.004	0.004	Phase V, Jan 17, 1994
Treatment Chemicals			
Acrylamide	TT+	zero	Phase II, Jul 30, 1992
Epichlorophydrin	TT+	zero	Phase II, Jul 30, 1992

* Zero is just a concept, as it is impossible to detect zero. All analytical techniques have detection limits greater than zero.

\+ Treatment technique. The allowable monomer level limits in products used during water treatment, storage, and distribution are: 0.05 percent acrylamide in polyacrylamide dosed at 1 ppm, and 0.01 percent residual epichlorohydrin concentration dosed at 20 ppm (based upon tests or manufacturer's certification). Water systems using a product containing acrylamide and epichlorohydrin must certify to the State that the amount of residual monomer in the polymer and the dosage rate would not cause the concentration to exceed the above level. Styrene, since it is also related to water treatment chemicals, also has a specified treatment technique level of 1 ppm styrene in styrene copolymers used as direct additives and as resin in order to aid in complying with the MCL.

c. *Monitoring.*

(1) All organic contaminants, with the exception of TTHMs, are monitored in accordance with the standardized monitoring framework (see paragraph 3-6). One sample must be collected at each entry point to the distribution system. Monitoring requirements are presented in Figures 4-5 and 4-6. Systems with 150 or more service connections must complete initial monitoring for Phase II and Phase V organics within the first 3-year compliance period (1993-1995). Systems with fewer than 150 service connections must complete initial monitoring for Phase II organics in the first 3-year compliance period, and for Phase V organics in the second 3-year compliance period (1996-1998). All systems

Volatile Organic Chemical Monitoring Flowchart

Source: Summary of Phase II Regulations, EPA Doc. No. 570/9-91-022, October 1991.

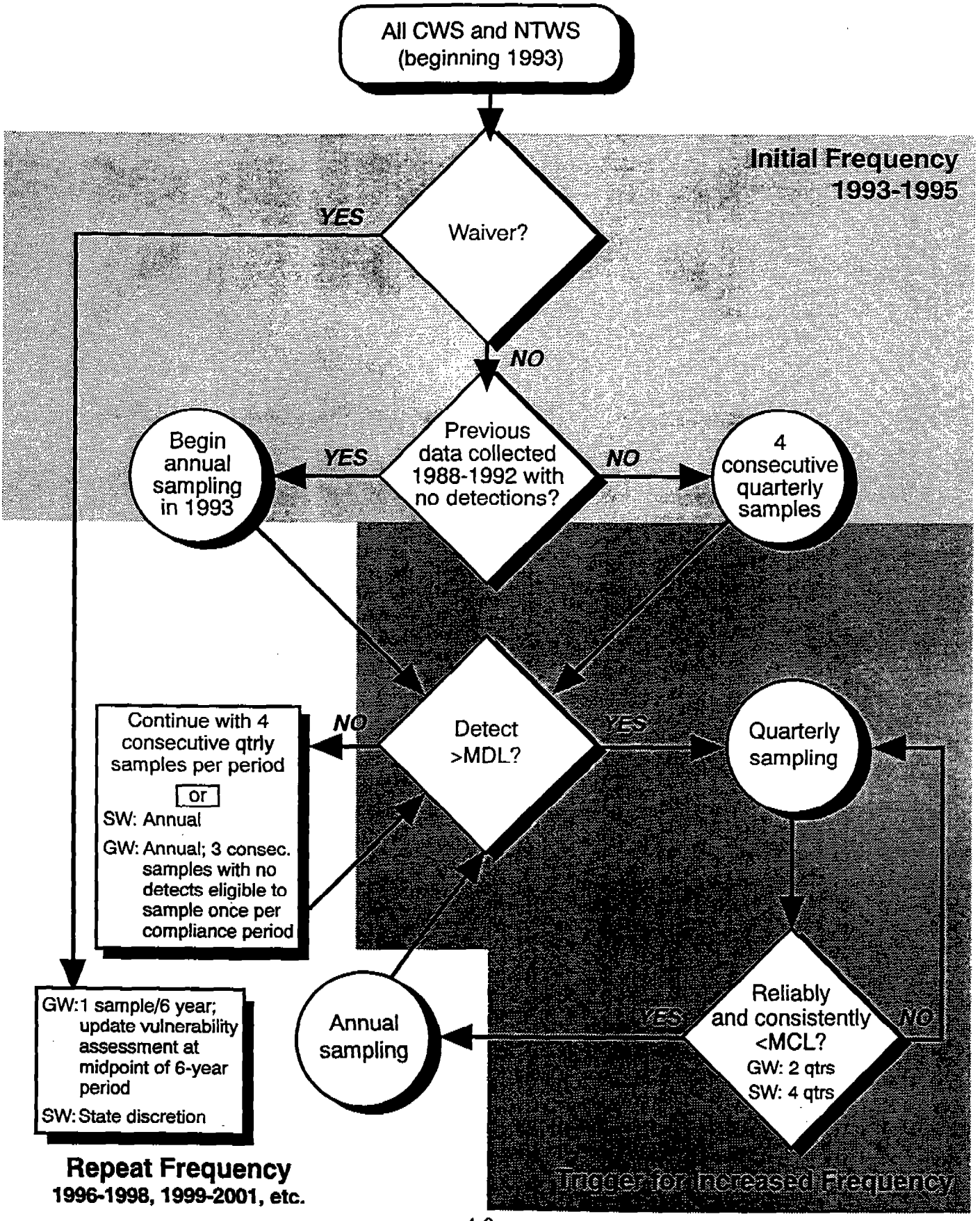


Figure 4-5.

Pesticide/Synthetic Organic Chemical Monitoring Flowchart

Source: Summary of Phase II Regulations, EPA Doc. No. 570/9-91-022, October 1991.

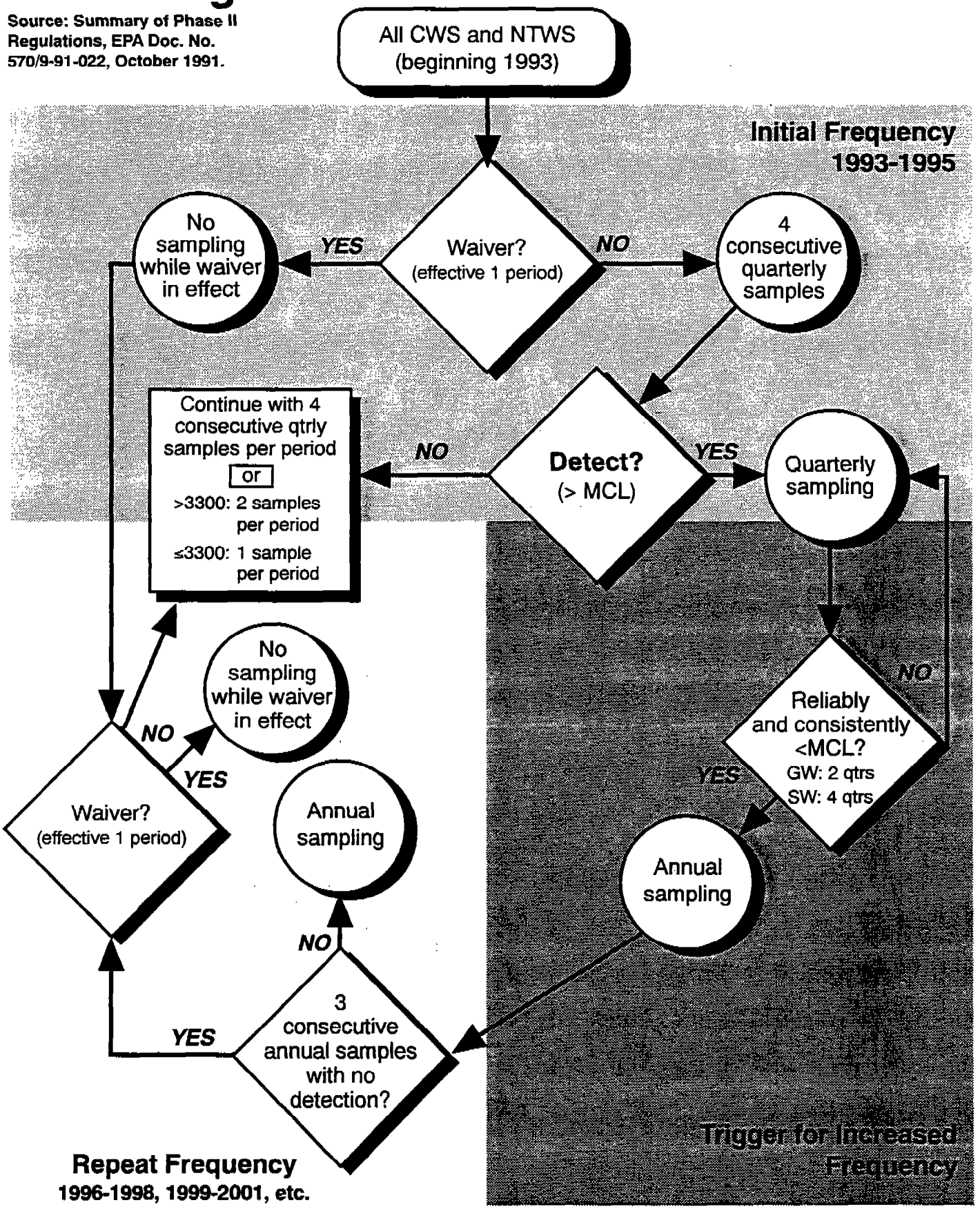


Figure 4-6.

should have already completed initial monitoring for Phase I organics and should have established quarterly TTHM monitoring if applicable. Repeat monitoring for Phase I organics can be performed in accordance with the Standardized Monitoring Framework established for Phase II and Phase V organics.

(2) Systems required to monitor for TTHMs must do so every quarter. At least four samples shall be taken for each treatment plant used by the system. One or more of the samples must come from locations within the distribution system reflecting the maximum residence time (i.e., locations furthest from the water treatment plant). The remaining samples may come from representative locations throughout the distribution system. Compliance with the TTHM MCL is based upon comparison with the RAA results. Reduced sampling is permitted at the discretion of the State.

d. *Compliance Determination.* Systems that monitor quarterly or semiannually must compare the RAA of the samples to the MCL to determine compliance status. For systems that sample on an annual or less frequent basis (i.e., once per compliance period), the system is in violation if one sample (or the average of the original and confirmation sample) at any point exceeds the MCL.

e. *BATs.* BATs for treatment and removal of regulated organics are contained in Appendix E.

4-3. Radiological Contaminants

a. *Applicability*. The NIPDWR radiological MCLs apply to all CWSs.

b. *Standards*. Gross alpha particle activity and radium-226/228 are regulated by MCLs. Beta particles and photon radioactivity from man-made radionuclides in drinking water are regulated by a limit on the annual dose equivalent to the total body or any internal organ. Specific beta and/or photon emitters to be monitored include tritium, strontium-89 and 90, iodine-131, and cesium-134. The proposed Phase III Rule will reevaluate these regulations and will set MCLs for other radiological contaminants. Paragraph 4-10 includes a brief discussion of the proposed Phase III Rule. Until Phase III is finalized, systems must continue to comply with the NIPDWR. Table 4-3 contains a list of current MCLs for radiological contaminants.

TABLE 4-3. RADIOLOGICAL MCLs AND EFFECTIVE DATES

Contaminant	MCL (pCi/L)	Effective Date
Gross Alpha	15*	NIPDWR
Combined Radium-226/228	5	NIPDWR
Gross Beta and Photon Emitters	4 mrem+	NIPDWR
Tritium	20,000+	NIPDWR
Strontium-90	8+	NIPDWR
Strontium-89	=+	NIPDWR
Cesium-134	=+	NIPDWR
Iodine-131	=+	NIPDWR

* Adjusted gross alpha particle activity, including radium-226, but excluding radon and uranium.

\+ The average annual concentration of beta particle and photon radioactivity from all man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 milirem/year. Compliance with this standard is assumed if the gross beta activity does not exceed 50 pCi/L, and if the concentrations of tritium or strontium-90 do not exceed the listed values. If both tritium and strontium-90 are present, the sum of their annual dose equivalents cannot exceed 4 milirem/year.

=+ Concentrations of these beta emitters causing 4 milirem/year total body or organ dose equivalents shall be calculated based upon a 2 L/day drinking water intake using the 168 hour data listed in the NBS occupational exposure handbook.

c. *Monitoring and Compliance Determination.*

(1) Monitoring requirements are presented in Figure 4-7. More frequent or reduced monitoring may be required/permitted by the State. One sample is required for each entry point to the distribution system. States may require systems with two or more sources, each with different concentrations of radioactivity, to monitor at the source and within the distribution system.

Radiological Monitoring Flowchart

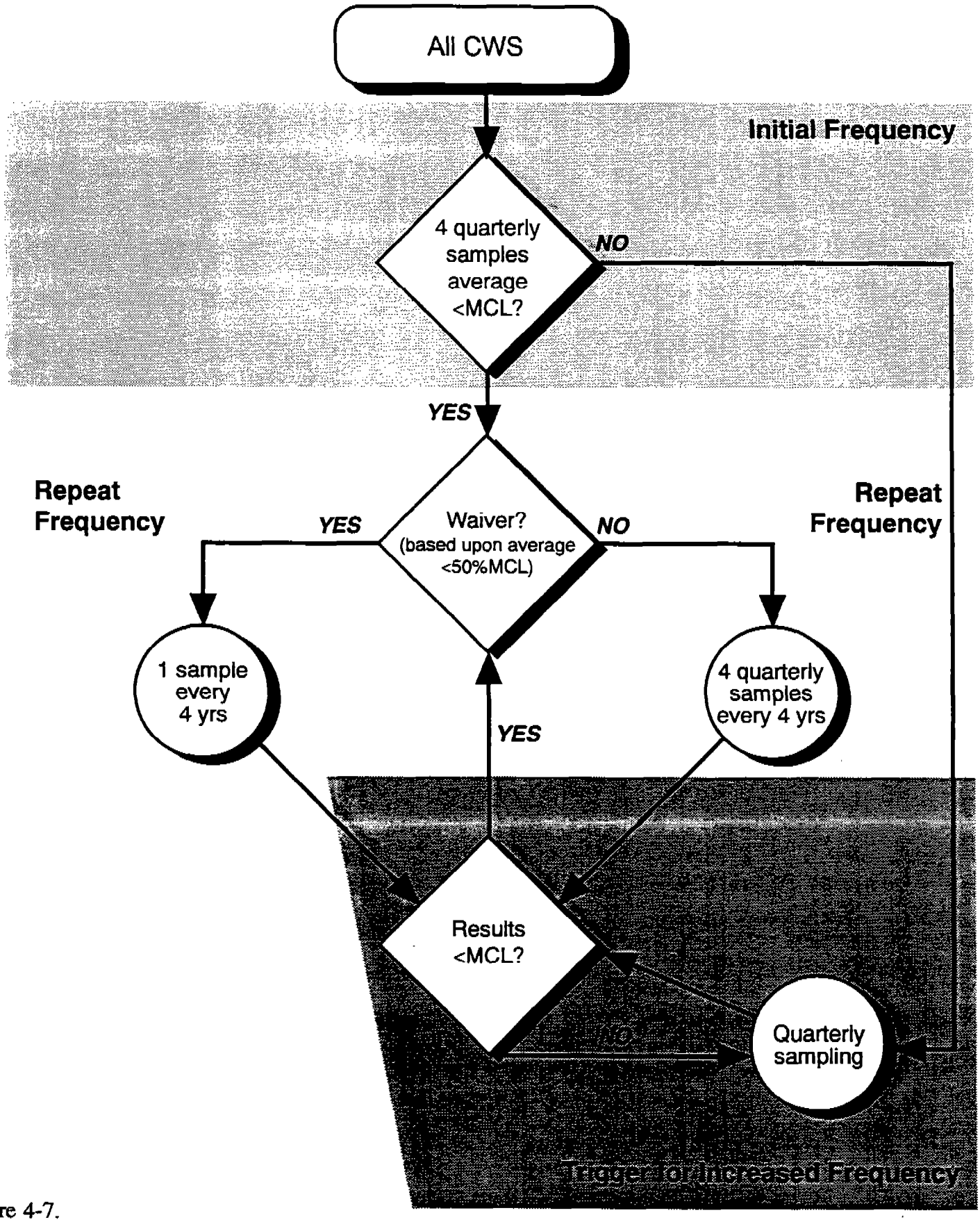


Figure 4-7.

(2) Analysis for radium-226/228 may be avoided if the gross alpha activity in that particular sample is less than 5 pCi/L. Analysis for radium-228 may be avoided if the radium-226 concentration does not exceed 3 pCi/L.

(3) Monitoring requirements for beta and photon radioactivity apply only to surface water systems serving over 100,000 people. States may require ground-water systems to monitor as well. Samples are analyzed for gross beta activity, iodine-131, strontium-90 and tritium. Analysis for strontium-89 and cesium-134 may be avoided if gross beta activity in that particular sample does not exceed 15 pCi/L.

d. *BATs*. Appendix E lists the BATs for removal of radiological contaminants.

4-4. Microbiological Contaminants

Microbiological contaminants are regulated under the Total Coliform Rule (TCR) and the Surface Water Treatment Rule (SWTR). The TCR, reflected in 40 CFR 141 as microbiological contaminant requirements, regulate total coliform bacteria including fecal coliform and *Escherichia coli* (E.coli). The SWTR (40 CFR 141, Subpart H, "Filtration and Disinfection") regulates *Giardia lamblia*, viruses, heterotrophic bacteria, and *Legionella*. Due to their complexity, each rule is discussed separately below.

4-5. Total Coliform Rule

a. *Applicability*. The TCR applies to all PWSs, both community and non-community. NCWSs are eligible for reduced frequency monitoring.

b. *Standard*. The MCLG for total coliform bacteria (including fecal coliform and E.coli) is zero. The MCL is based upon the presence/absence of total coliforms -- no more than 5 percent positive samples per month for systems analyzing at least 40 samples per month, and no more than one positive sample per month for systems analyzing less than 40 samples. In addition, the MCL is violated whenever both a routine and a repeat sample are total coliform positive and at least one is also fecal coliform positive. Requirements of the TCR are reflected in 40 CFR 141.21, .52, and .63.

c. *Monitoring*.

(1) Each PWS must develop a written monitoring schedule and plan, denoting the routine and repeat sampling sites. These sites should be well marked on a recent copy of the system's distribution system map. Monitoring locations should be representative of all

areas of the system. Installations may choose to use the same fixed points for routine monitoring each month or may choose to rotate them in groups to ensure the most thorough surveillance of the entire distribution system. The State may review and revise the plan.

(2) All CWSs must monitor for total coliforms monthly. The number of samples to be collected is based upon the number of people served by the system. Table 4-4 lists the minimum required samples for various populations. Non-community systems using protected ground water and serving 1,000 people or less must monitor once each calendar quarter the system provides water to the public. Non-community systems using protected ground water and serving more than 1,000 people during any month, or non-community systems using surface water or ground water under the influence of surface water must monitor at the same frequency as the like-sized community water system.

TABLE 4-4. NUMBERS OF MINIMUM REQUIRED TOTAL COLIFORM SAMPLES

Population	#Samp.	Population	#Samp.	Population	#Samp.
25-1000*	1+	21,501 - 25,000	25	450,001 - 600k‡	210
1001 - 2500	2	25,001 - 33,000	30	600,001 - 780k	240
2501 - 3300	3	33,001 - 41,000	40	780,001 - 970k	270
3301 - 4100	4	41,001 - 50,000	50	970,001 - 1230k	300
4101 - 4900	5	50,001 - 59,000	60	1,230,001 - 1520k	330
4901 - 5800	6	59,001 - 70,000	70	1,520,001 - 1850k	360
5801 - 6700	7	70,001 - 83,000	80	1,850,001 - 2270k	390
6701 - 7600	8	83,001 - 96,000	90	2,270,001 - 3020k	420
7601 - 8500	9	96,001 - 130,000	100	3,020,001 - 3960k	450
8501 - 12,900	10	130,001 - 220,000	120	> 3,960,000	480
12,901 - 17,200	15	220,001 - 320,000	150		
17,201 - 21,500	20	320,001 - 450,000	180		

* Includes PWSs which have >15 service connections but serve <25 people.
\+ State may reduce to quarterly if system is served by protected ground water and is free of sanitary defects.
‡ k = ,000

(3) Systems collecting multiple samples per month must collect them at regular intervals throughout the month. Systems serving less than 4,900 people, using protected ground water and collecting from different sites may collect all samples on a single day.

(4) Repeat samples must be collected whenever a routine sample tests total coliform positive. The samples must be collected within 24 hours of notification of a positive result. Repeat samples must be taken from the same tap that sampled total coliform positive and from an upstream and downstream location, each within 5 service connections of

the original tap. The State may waive or vary either the downstream or upstream sampling requirement if conditions within the distribution system do not allow for these samples to be taken (e.g., the original tap is located on a dead end). If one or more of the repeat samples is total coliform positive, then an additional set of repeat samples must be collected in the manner specified above. Monitoring personnel must repeat the process until no samples are total coliform positive. If total coliforms continue to be detected, however, the State may waive the repeat sampling requirements. The State may waive or vary any of the specific repeat sampling requirements based upon site specific conditions of the system. The repeat monitoring scheme is depicted in Figure 4-8.

(5) All total coliform positive samples, both original and repeat, must be further analyzed for fecal coliforms or E.coli. If any total coliform positive sample is also fecal/E.coli positive, the State must be notified by the end of the next business day.

(6) A fecal coliform/E.coli positive repeat sample or a fecal/E.coli positive original followed by a total coliform positive repeat is an acute violation and requires public notification by electronic media within 72 hours. The mandatory language for the public notification can be found in 40 CFR 141, Subpart D.

d. *Invalidation of Samples*. Under certain conditions, the State may invalidate coliform samples so they do not count in compliance calculations. These conditions include the following:

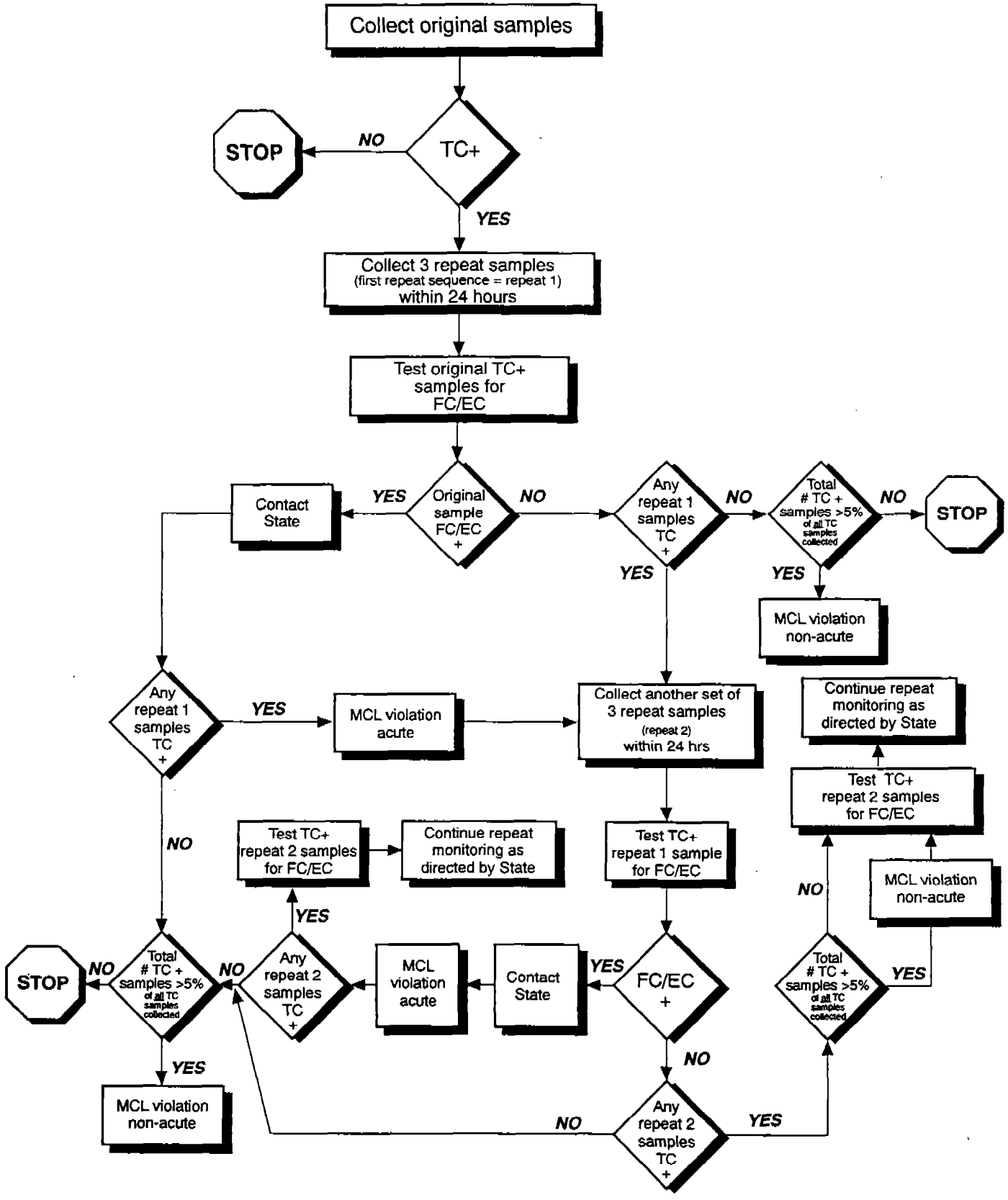
(1) The laboratory establishes that improper sample analysis caused the total coliform positive result.

(2) The State, on the basis of evaluating the repeat samples, determines the total coliform positive sample resulted from a domestic or other non-distribution system plumbing problem (e.g., a problem restricted to the original positive tap/sample).

(3) The State has substantial grounds to believe that the total coliform positive result is due to a circumstance or condition which does not reflect water quality in the distribution system. In this case, the system still collects the required repeat samples and uses them in determining compliance with the MCL for total coliforms.

e. *Analytical Methods*. The AR 40-5 (paragraph 12-2h) requires the Preventive Medicine Activity (PVNTMED) or Installation Medical Authority (IMA) at an installation to perform bacteriological surveillance of the potable drinking water system as required by the NPDWR. This surveillance may consist of the PVNTMED performing the required bacteriological monitoring of the water system or providing oversight to any other entity actually performing the monitoring in accordance with the TCR. If the PVNTMED performs

Total Coliform Monitoring Flowchart



KEY: TC - total coliform; + - positive; FC/EC - fecal coliform or e. coli; # - number

NOTE: When an MCL is violated, the State must be contacted and public notification provided. Acute violations require public notification within 72 hours by electronic media. Non-acute violations require public notification within 14 days.

Figure 4-8.

the compliance monitoring for the TCR, the samples may be analyzed onsite. There are several acceptable methods for total coliform, fecal coliform, and E.coli analysis for compliance with the TCR. More information on each method can be found in the Standard Methods for the Examination of Water and Wastewater.

(1) Total coliforms: membrane filter; multiple tube fermentation; presence-absence; Minimal Medium ONPG (MMO) - MUG, such as Colilert® and Colisure®.

(2) Fecal coliforms: EC medium.

(3) E.coli: EC medium + MUG; nutrient agar + MUG; MMO-MUG.

f. *BATs*. The EPA lists the following as good management practices and techniques to maximize compliance with the TCR in 40 CFR 141.63. Often, States require that these practices be performed to safeguard consumer health.

(1) Protection of wells from contamination by coliforms by appropriate placement and construction.

(2) Maintenance of a disinfectant residual throughout the distribution system.

(3) Proper maintenance of the distribution system including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, and continual maintenance of positive water pressure in all parts of the distribution system.

(4) Filtration and disinfection as noted in 40 CFR 141, Subpart H.

(5) The development and implementation of an EPA-approved State WHP program under Section 1428 of the SDWA.

g. *Sanitary Surveys*. Those CWSs which do not collect 5 or more samples per month must have completed an initial sanitary survey by 29 June 1994. Those NCWSs which do not collect 5 or more samples per month must complete an initial sanitary survey by 29 June 1999. Repeat surveys must be performed every 5 years. Non-community

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systems using only protected and disinfected ground water, as defined by the State, can perform the repeat surveys every 10 years. These sanitary surveys must be performed by the State or another official approved by the State.

4-6. Surface Water Treatment Rule - 40 CFR 141, Subpart H

a. *Applicability*. The SWTR applies to all PWSs that use a surface water source or a ground-water source that is determined to be under the direct influence of a surface water (GWUDI). The State has the responsibility to determine whether or not ground-water systems are under the direct influence of a surface water and provide proper notification. States may require systems to conduct studies to provide information to make this determination. Systems using a source classified as a GWUDI must begin monitoring as required by the SWTR within 6 months of the notification and must be in compliance (filtering or non-filtering) within 18 months of notification. Compliance with the rule can become complex and the text here includes only the major requirements. Appendix A lists several documents which explain in more detail the requirements of the SWTR. The EPA's manual, Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources, March 1991, details the exact regulatory requirements. The U.S. Army Environmental Hygiene Agency (USAEHA) TG No. 199 also provides more detailed information than what is found in this TG.

b. *Standard*. The SWTR was finalized on June 29, 1989. It regulated several waterborne pathogens which may be found in surface waters – *Giardia lamblia*, *Legionella*, viruses, and heterotrophic bacteria. An MCLG of zero has been established for *Giardia*, *Legionella*, and viruses. The EPA recommends levels of heterotrophic bacteria as close to zero as possible, but there is no formal MCLG. Since monitoring for some of these microorganisms (*Giardia*, *Legionella*, and viruses) is difficult and expensive, the rule regulates turbidity (which can interfere with disinfection, therefore reducing microbial control) and establishes treatment techniques to ensure adequate removal or inactivation of these organisms. The EPA also recommends a turbidity as close to zero as possible, but did not establish an MCLG. Turbidity requirements vary depending upon the type of filtration process used. The treatment technique requirements consist of installation and operation of filtration and/or disinfection treatment that provides 99.9 percent (3-log) removal and/or inactivation of *Giardia lamblia* and at least 99.99 percent (4-log) removal and/or inactivation of viruses. Treatment for these microbes ensures protection from *Legionella* and heterotrophic bacteria, since they are less resilient organisms. Systems that employ filtration must have met their requirements by 29 June 1993. Systems that do not filter the drinking water had to meet their requirements by 31 December 1990 or had to install filtration meeting the requirements by 29 June 1993.

c. *General System Requirements.* The SWTR was the first regulation to employ treatment techniques rather than establish MCLs for contaminants. It is imperative, then, in order to protect consumer health that all regulated systems are well operated to meet the treatment technique requirements. In order to ensure that systems are operated to the best of their ability to meet such strict treatment requirements, the SWTR requires that all regulated systems (surface water and GWUDI) are operated by a person properly certified by the State.

d. *Non-Filtering System Requirements.* Surface water and GWUDI systems that do not provide filtration of the drinking water must meet several criteria, both for source water and treated water, in order to continue to avoid filtration. If the requirements are not met, filtration must be installed within 18 months of failure to meet the requirements. Source and site specific requirements are listed in Table 4-5.

TABLE 4-5. NON-FILTERING SYSTEM CRITERIA*

Source Water Criteria
- fecal coliform $\leq$20/100 mL or total coliform $\leq$100/100 mL in 90% of samples taken over the past 6-months
- turbidity <5 NTU
- not previously identified as a source of waterborne disease

Site Specific Criteria
- redundant disinfection capability or automatic water feed shut-off device to ensure water entering distribution system has a residual of at least 0.2 mg/L
- disinfectant residual throughout the distribution system must be detectable in all samples taken (monitored at least as frequently as bacteriological parameters)
- compliance with the Total Trihalomethanes MCL, if applicable
- watershed control program
- annual onsite inspection of watershed control program and disinfection facilities by State or State-certified agent

* Exceptions are occasionally allowed. Consult the EPA Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources, March 1991.

Non-filtering systems are required to meet the treatment technique log-removal requirements through disinfection application alone. Non-filtering systems must monitor the source water for turbidity every 4 hours or continuously, and for bacteriological parameters weekly. The number of coliform samples required is population dependent as shown in Table 4-6. The

disinfectant residual must be monitored continuously for systems serving over 3,300 people. Table 4-7 contains the disinfectant residual samples required per day for systems serving less than 3,300 people.

TABLE 4-6. BACTERIOLOGICAL SAMPLING FREQUENCY

Pop. Served	Samples/Week
> 25,000	5
10,001 - 25,000	4
3,301 - 10,000	3
501 - 3,300	2
≤ 500	1

TABLE 4-7. DISINFECTANT RESIDUAL SAMPLES REQ'D

Pop. Served	Samples/Day
> 3,300	continuous
3,300 - 2,501	4
1,001 - 2,500	3
500 - 1,000	2
< 500	1

e. *Filtering System Requirements*. Surface water and GWUDI systems that provide filtration must meet specific performance requirements to ensure that required log-removals are being achieved. Filtering systems will achieve a portion of the total log-removal/inactivation through the treatment process (coagulation and sedimentation, if applicable, and filtration). The remainder of the requirements must be met through the log-inactivation of disinfection. There are several types of filtration technologies available for use and each is assumed by the EPA to have different log-removal capabilities when well operated. The exact log-removal capability and resulting log-inactivation required by disinfection are to be determined by the State for filtering systems using recommended EPA guidance (see Table 4-8) or detailed proof of removal capabilities from the system. Table 4-8 lists the expected log-removal, the resulting recommended log-inactivation required through disinfection, and the filtered water turbidity requirements for the various filtration technologies. Filtered water turbidities must be less than or equal to the maximum turbidity shown in Table 4-8 in at least 95 percent of the samples collected each month. Under no circumstances can filtered water turbidities exceed 5 NTU. Filtering systems serving over 500 people must monitor filtered water turbidity every 4 hours or continuously. Systems serving less than 500 people may monitor filtered water turbidity once per day. Disinfectant residual monitoring requirements for filtering systems is the same as for non-filtering systems.

TABLE 4-8. FILTRATION TECHNOLOGY LOG-REMOVAL AND TURBIDITY REQUIREMENTS

Filtration Type	Expected Log-Removals Giardia/viruses	Recommended Disinfection (Log-Inactivation) Giardia/viruses	Maximum Turbidity
Conventional*	2.5/2.0	0.5/2.0	0.5
Direct-+	2.0/1.0	1.0/3.0	0.5
Slow Sand	2.0/2.0	1.0/2.0	1.0
Diatomaceous Earth	2.0/1.0	1.0/3.0	1.0

* Conventional treatment consists of coagulation/flocculation, sedimentation, and filtration.
+ Direct filtration consists of addition of a filtration aid and filtration.

f. *Disinfection Requirements*. The adequacy of disinfection provided is determined by achievement of the required CT for given site and water quality conditions. The CT, measured at point X, is defined as the residual concentration of the disinfectant at point X multiplied by the time, in minutes, that the disinfectant has been in contact with the water up to point X. The required CT values are detailed in 40 CFR 141, Subpart H, and the referenced EPA guidance manual. The CT, measured at the point of the first consumer (often the water treatment plant itself), must be measured daily during peak hourly flow rate for non-filtering systems and should be measured by filtering systems to ensure that they are meeting the required inactivation by disinfection. There are a number of disinfectants used to treat drinking water including chlorine, chlorine dioxide, chloramine, and ozone. The CT required to achieve a certain log-inactivation differs for each disinfectant and is a function of water temperature, pH, and the disinfectant contact chamber design. The EPA guidance manual contains detailed information on calculating CT values on a "desktop" basis. Some States may require detailed studies of disinfectant contact chambers, referred to as "tracer studies." Tracer studies more accurately determine the true contact time of treated water prior to being distributed and may indicate greater disinfection effectiveness than that determined by a desktop approach.

g. *Reporting Requirements*. Monitoring results must be reported monthly to the State to ensure that systems are meeting the requirements under the SWTR. Detailed reporting requirements are included in 40 CFR 141, Subpart H. A summary appears below in Table 4-9.

TABLE 4-9. SWTR REPORTING REQUIREMENTS

Non-Filtering Systems

1. Source water quality (turbidities, total and/or fecal coliforms)
2. Disinfection information (residuals, pH, temperature, daily CTs)
3. Report of compliance with the watershed control program*
4. Copy of the State's (or State certified agent's) report of the onsite inspection*
5. Notice of waterborne disease outbreak; turbidity exceeding 5 NTU; disinfectant residual below 0.2 mg/L in water entering the distribution system†

Filtering Systems

1. Filtered water turbidity
2. Disinfection information (residuals)
3. Notice of waterborne disease outbreak, turbidity exceeding 5 NTU, residual below 0.2 mg/L in water entering the distribution system†

* Annually.

† If the event occurs, report as soon as possible but no later than by the end of the next business day.

4-7. Lead and Copper Rule - 40 CFR 141, Subpart I

a. *Applicability/Responsibility.* The Lead and Copper Rule applies to CWSs and NTNC water systems. The purveyor of water, in most cases the Directorate of Engineering and Housing (DEH) or Directorate of Public Works (DPW), at an installation is responsible for monitoring and compliance with the rule; however, the IMA should be contacted to provide valuable input on selection of sample sites to be most protective of consumer health.

b. *Standard.* The Lead and Copper Rule was finalized on June 7, 1991, with corrections issued on July 15, 1991, June 29, 1992, and June 30, 1994. It established revised standards for lead and copper content in drinking water.

(1) The majority of lead and copper concentrations in water received by the consumer is a result of leaching of the metals from water service lines and internal plumbing materials rather than contamination of source water. Corrosive waters, as defined by various corrosivity indicators [e.g., the Langelier Saturation Index (LSI)], enhance the leachability of

lead and copper. As a result, the rule regulates the levels of lead and copper found at the consumer's water tap. The rule requires monitoring of tap water lead and copper levels (from sink taps, not drinking fountains) and distributed water quality characteristics. The Lead and Copper Rule was designed to be most protective of the health of children and developing infants in response to lead's detrimental effects to mental development.

(2) The MCLG for lead is zero and for copper is 1.3 mg/L. Action levels rather than MCLs have been established for regulating lead and copper in drinking water: 0.015 mg/L for lead and 1.3 mg/L for copper to be met at the 90th percentile of the 1 liter first draw tap water samples (i.e., lead and copper concentrations less than the action levels in at least 90 percent of the taps sampled). First draw samples are collected by catching the first water that comes from the tap, not allowing for any flushing or wasting of water. Exceeding the action level requires a system to take actions to correct the lead and copper leaching problem within the system and to educate and protect the consumer from exposure to lead from drinking water.

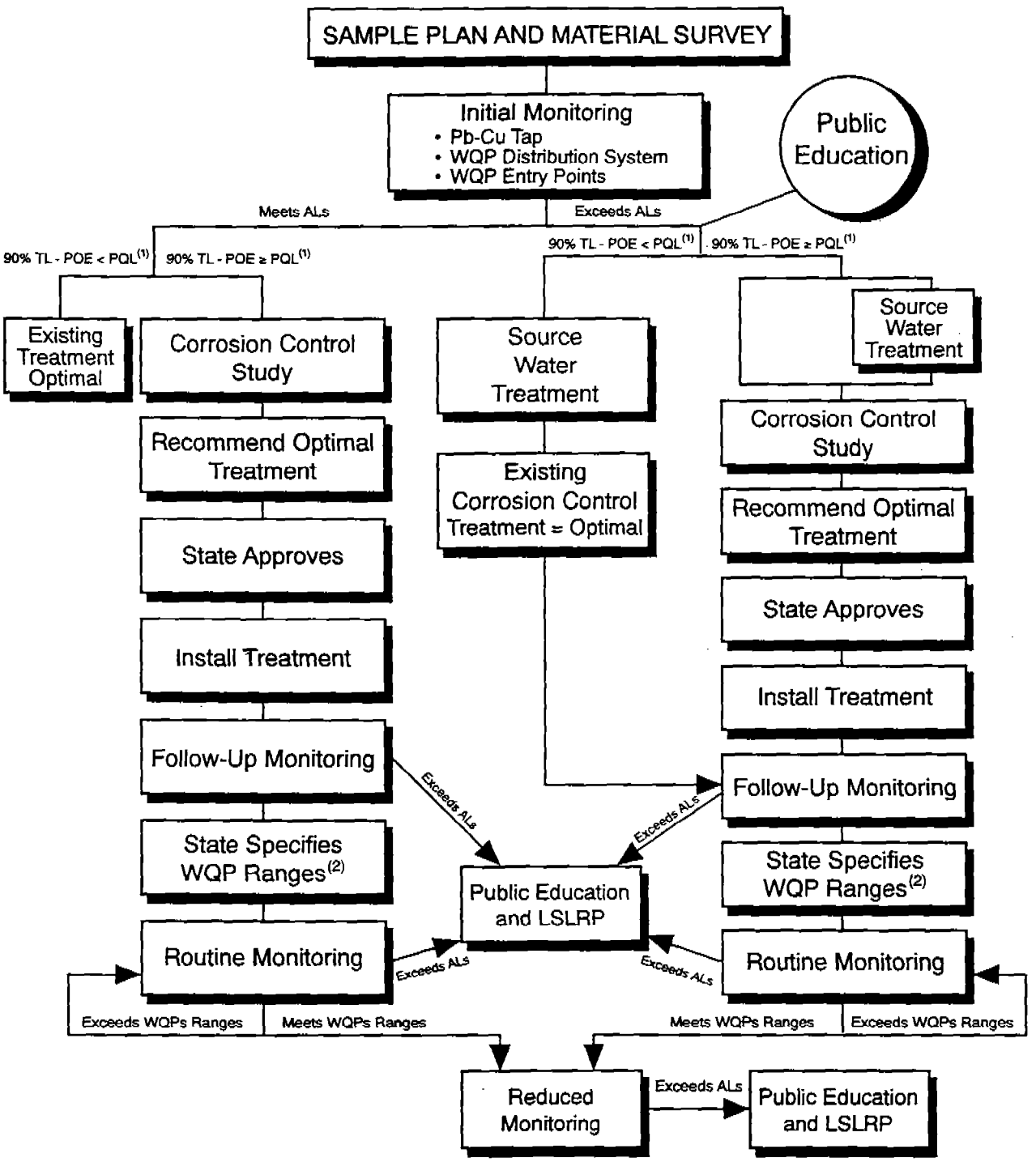
c. *System Sizes and Monitoring Periods.* The Lead and Copper Rule divides water systems into three size categories for compliance with the monitoring schedule: large systems serve more than 50,000 people; medium systems serve between 3,301 and 50,000 people; and small systems serve 3,300 or less people. Initial monitoring for the Lead and Copper Rule occurs for two consecutive 6-month monitoring periods, although small and medium systems that exceed action levels during the first monitoring period need not sample for a second 6-month monitoring event. Schedules for continued monitoring depend upon the results of the first two monitoring periods. Large systems began their first 6-month monitoring period in January 1992, medium systems began their first 6-month monitoring period in July 1992, and small systems began their first 6-month monitoring period in July 1993. The basic steps required for compliance for the different sized systems are contained in Figures 4-9 and 4-10.

d. *Monitoring.*

(1) Lead and Copper Content. The Lead and Copper Rule requires systems to monitor lead and copper content at consumers' taps within homes and workplaces. The number of tap samples required is determined by the number of people served by the system, as reflected in Table 4-10. The location of the samples must be chosen according to specific criteria as defined by the rule. Targeted locations are divided into Tiers 1, 2, and 3. Table 4-11 defines the locations included in the tiers. Systems unable to get all required samples from Tier 1 sites must have the sample site plan approved by the State.

Lead & Copper Rule Implementation for Large Systems

Source: Lead and Copper Rule Guidance Manual, Volume I: Monitoring, EPA, September 1991.



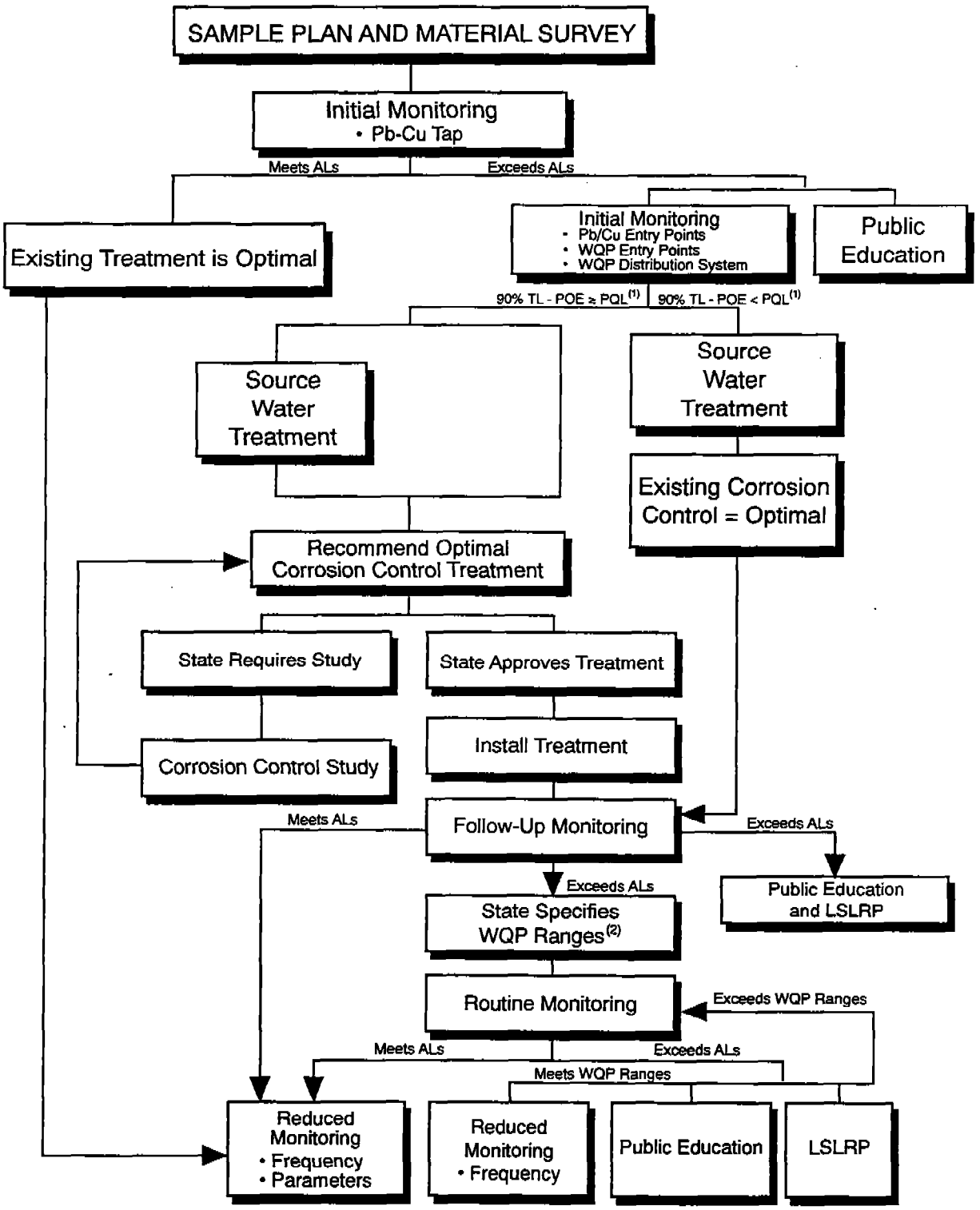
(1) The 90th % tap water level (TL) minus the highest source water concentration [Point of Entry (POE)] is < or ≥ the practical quantitative level (PQL).

(2) WQP = Water Quality Parameter, AL = Action Level, LSLRP = Lead Service Line Replacement Plan

Figure 4-9.

Lead & Copper Rule Implementation for Medium and Small Systems

Source: Lead and Copper Rule Guidance Manual, Volume I: Monitoring, EPA, September 1991.



(1) The 90th % tap water level (TL) minus the highest source water concentration [Point of Entry (POE)] is < or ≥ the practical quantitative level (PQL) - A second round of Pb/Cu-Tap and Pb/Cu-POE would be required for this concentration

(2) WQP = Water Quality Parameter, AL = Action Level, LSLRP = Lead Service Line Replacement Plan

Figure 4-10.

TABLE 4-10. NUMBER OF LEAD AND COPPER SAMPLES REQUIRED

Population Served	Standard Number of Samples	Reduced Number of Samples
> 100,000	100	50
10,001 - 100,000	60	30
3,301 - 10,000	40	20
501 - 3,300	20	10
101 - 501	10	5
≤ 100	5	5

TABLE 4-11. TIER DEFINITIONS

Tier	Sites Included
TIER 1	single family structures* that: 1) contain copper pipes with lead solder installed after 1982 or lead pipes 2) served by lead service lines
TIER 2+	buildings or multi-family structures that: 1) contain copper pipes with lead solder installed after 1982 or lead pipes 2) served by a lead service line
TIER 3	single family structures* that contain copper pipes with lead solder installed before 1983

* For community water systems whose area served consists of more than 20 percent multi-family residences, these structures may be included in the sampling pool.

\+ Non-transient, non-community water systems will consider Tier 2 as Tier 1 for the sampling pool. Tier 3 then becomes Tier 2.

(2) Water Quality Parameters. Further monitoring for distributed water quality characteristics (pH, alkalinity, orthophosphate, silica, calcium, conductivity, water temperature) must be conducted by all large systems. Small and medium systems must monitor water quality parameters when the action levels are exceeded. Table 4-12 contains the number of water quality characteristic samples required.

TABLE 4-12. NUMBER OF WATER QUALITY SAMPLES REQUIRED

Population Served	Standard Number of Samples	Reduced Number of Samples
$\geq$ 100,000	25	10
10,001 - 100,000	10	7
3,301 - 10,000	3	3
501 - 3,300	2	2
101 - 501	1	1
$\leq$ 100	1	1

(3) Guidance. The EPA produced a detailed document, Lead and Copper Rule Guidance Manual Volume I: Monitoring, describing the steps involved in compliance monitoring which should be consulted when beginning to address the Lead and Copper Rule.

e. *Treatment Techniques*. Systems that exceed the lead and/or copper action level in either of the initial 6-month monitoring periods must begin corrosion control treatment. Guidance for corrosion control and studies is in the EPA manual, Lead and Copper Rule Guidance Manual Volume II: Corrosion Control Treatment. Source water treatment may be necessary in those instances where source lead and copper levels contribute to the levels at the consumer's tap. Exceeding the lead action level immediately triggers the requirement for a public education program to protect consumers from excess exposure to lead. Systems that exceed the lead action level after installation of optimal corrosion control and source water treatment may be required to replace lead service lines at a rate of 7 percent of the initial number of lead service lines per year.

f. *Reporting Requirements*. Up to five basic elements may have to be reported to the State under the Lead and Copper Rule: tap water sampling results for both lead and copper and water quality parameters, source water monitoring results, treatment technique application results (corrosion control, source water treatment, and lead service line replacement), public education program demonstration, and results of any additional lead and copper or water quality samples taken by the system. Monitoring results must be reported within the first 10 days of the end of the monitoring period.

g. *Public Education Programs*. The importance of public education programs is not only to remain in compliance with the Lead and Copper Rule, but also to protect the health of the consumers. The rule has very specific required text and content for a public education program that is detailed in the rule and in 40 CFR 141, Subpart I. Consumers can greatly reduce their exposure to lead from drinking water by following a few simple steps as detailed in Table 4-13.

TABLE 4-13. INTERIM CONSUMER REDUCTION OF LEAD AT THE TAP

1. Flush taps prior to collecting water for drinking or cooking. Flushing the tap means running the cold water faucet until the water gets noticeably colder, usually 30 seconds to a minute for single family homes and a few minutes longer for apartments or offices in large buildings.

2. Use only the cold water tap; hot water is more corrosive and will leach more lead from interior plumbing.

3. To conserve water, fill a couple of bottles for drinking after flushing the tap and store them in the refrigerator.

4. Remove loose lead solder and debris from newly installed plumbing materials by removing the faucet strainers from all taps and running the water at full speed for 3 to 5 minutes.

5. Have an electrician check your wiring to determine if it is grounded to the piping in your house. If electric wiring can be grounded elsewhere, contract a certified electrician to do so. The excess electrical current to the pipes promotes corrosion.

6. Home treatment devices installed on the tap used for drinking and cooking water or even bottled water can be purchased to provide protection for your family if lead levels in your home are in excess of 0.015 milligrams per liter. Any device used should be approved by the National Sanitation Foundation [NSF International, 3475 Plymouth Rd., PO Box 130140, Ann Arbor, MI 48113-0140 Phone: (313) 769-8010, Fax: 313-769-0109]. Ask the supplier for proof of this certification.

4-8. Special Regulations and Monitoring - 40 CFR 141, Subpart E

a. *Unregulated Contaminant Monitoring*. Both Phase I and Phase II Rules require CWSs and NTNC water systems to monitor for unregulated contaminants. Phase V revised the total list of contaminants as contained in Table 4-14.

TABLE 4-14. UNREGULATED CONTAMINANT LIST

Phase I

Organics

(1) Chloroform
(2) Bromodichloromethane
(3) Chlorodibromomethane
(4) Bromoform
(5) Dibromomethane
(6) m-Dichlorobenzene
(7) 1,1-Dichloropropene
(8) 1,1-Dichloroethane
(9) 1,1,2,2-Tetrachloroethane
(10) 1,3-Dichloropropane
(11) Chloromethane
(12) Bromomethane
(13) 1,2,3-Trichloropropane
(14) 1,1,1,2-Tetrachloroethane
(15) Chloroethane
(16) 2,2-Dichloropropane
(17) o-Chlorotoluene
(18) p-Chlorotoluene
(19) Bromobenzene
(20) 1,3-Dichloropropene

To Be Done At State's Discretion

(1) 1,2,4-Trimethylbenzene
(2) 1,2,3-Trichlorobenzene
(3) n-Propylbenzene
(4) n-Butylbenzene
(5) Naphthalene
(6) Hexachlorobutadiene
(7) 1,3,5-Trimethylbenzene
(8) p-Isopropyltoluene
(9) Isopropylbenzene
(10) Tert-butylbenzene
(11) Sec-butylbenzene
(12) Fluorotrichloromethane
(13) Dichlorodifluoromethane
(14) Bromochloromethane

Phase II

Organics

(1) Aldicarb
(2) Aldicarb Sulfone
(3) Aldicarb Sulfoxide
(4) Aldrin
(5) Butachlor
(6) Carbaryl
(7) Dicamba
(8) Dieldrin
(9) 3-Hydroxycarbofuran
(10) Methomyl
(11) Metolachlor
(12) Metribuzin
(13) Propachlor

Inorganics

(1) Sulfate

Monitoring for Phase I unregulated contaminants consists of four consecutive quarterly samples for surface water systems and one sample at each entry to the distribution system for ground-water systems. All systems should have performed initial monitoring for Phase I unregulated contaminants. Monitoring for Phase II unregulated contaminants consists of four consecutive quarterly samples for organic contaminants and one sample at each entry to the distribution system for inorganic contaminants, regardless of the source. Initial monitoring for Phase II unregulated contaminants must be completed by 31 December 1995. Repeat monitoring must be performed every 5 years. Small systems (<150 service connections) have the option to submit a letter of system availability for sampling to the State in lieu of collecting samples. Other systems may apply for waivers from the State.

b. *Sodium.* Although sodium does not have an MCL, its concentration in drinking water can cause serious health effects for those consumers with special dietary needs (i.e., low sodium diet). All CWSs using surface water must analyze the water entering the distribution system for sodium annually. All CWSs using only ground water must analyze for sodium once every 3 years. Initial monitoring should have been completed by all affected systems by February 27, 1983. One sample must be collected for each treatment plant or well upon entry to the distribution system. The results must be reported to the State and to the appropriate local and State public health officials. Some States regulate the amount of sodium in public drinking water supplies to protect consumer health.

c. *Corrosivity Characteristics.* The corrosivity of distributed water greatly influences the leaching of metals within the distribution system. The leached metals increase the levels of metals reaching the consumer. All CWSs must monitor the water entering the distribution system for corrosivity characteristics at least one time. Initial monitoring should have been completed by all affected systems by February 27, 1983. Two samples per plant for surface water sources must be collected, one in the winter and one in the summer. Ground-water systems must take at least one sample per plant, or may, at the State's discretion, take one sample if all plants (wells) draw from the same aquifer. Determination of the corrosivity of the water shall include measurement of pH, calcium hardness, alkalinity, temperature, total dissolved solids (total filterable residue), and calculation of the LSI. Calculations for the LSI can be found in a copy of the Standard Methods for the Examination of Water and Wastewater. Assessing the finished water's corrosivity should also be a good indication as to whether or not the system will have trouble meeting the Lead and Copper Rule [see paragraph 4-7b(1)]. States may also require monitoring for other parameters associated with increased corrosivity of water, such as sulfates and chloride.

d. *System Materials Survey.* All CWSs must identify the use of any of the following materials anywhere within the distribution system or plumbing and report the findings to the State: lead or lead alloys, copper, galvanized piping, iron, asbestos cement, vinyl-lined asbestos cement pipe, or coal tar-lined pipes or tanks. All existing CWSs must have completed this system materials survey by February 27, 1983.

4-9. Future Regulations

There are several drinking water regulations which have been proposed, or will soon be proposed, that will affect Army drinking water systems. A brief discussion of each appears in Sections 4-10 through 4-15. Appendix F contains the latest regulatory schedule for the anticipated rules.

4-10. Radiological Contaminants (Phase III) - 56 FR 33050

a. *Systems Affected.* The Phase III Rule, as proposed on 18 July 1991, will apply to all CWSs and NTNC water systems. The rule will have the biggest impact on ground-water systems.

b. *Standards.* As discussed in paragraph 4-3, Phase III will revise the current NIPDWR MCLs for radiological contaminants and will add an MCL for uranium. The proposed rule added an MCL for radon-222, but there is currently much dispute about its benefit. Many feel that the cost of compliance is too great for the risk reduction achieved. Congress has prohibited the expenditure of fiscal year 1995 monies to propose an MCL for radon; therefore, the final Phase III Rule will most likely not include radon-222. Table 4-15 contains a list of the proposed MCLs for radiologicals to be regulated under the Phase III Rule.

c. *Monitoring.* Monitoring for Phase III will follow the standardized monitoring framework of initial and base monitoring requirements. Systems may apply for a waiver to reduce monitoring frequency based upon initial monitoring results. Violation of the radon, alpha emitters, radium-226 or 228 MCL triggers quarterly monitoring, and violation of the beta particle and photon emitters MCL triggers monthly monitoring. The monitoring requirements discussed below are those of the proposed rule. Actual monitoring requirements should be discussed with the State after Phase III is finalized.

(1) Systems serving over 100,000 people and smaller systems determined by the State to be vulnerable will monitor for beta particle and photon emitters. Vulnerability will be based upon proximity to and discharges from facilities using or producing radioactive materials. Gross-beta activity will be monitored quarterly as a screen for beta and photon emitters. Tritium and strontium-90 must be monitored separately on an annual basis to ensure that the 4 mrem/year MCL is not exceeded. Strontium-89, cesium-134, and iodine-131 must be monitored depending upon the results of the beta and photon screen.

TABLE 4-15. PROPOSED RADIOLOGICAL MCLs

Contaminant	MCLG	MCL (pCi/L)
Adjusted Gross Alpha*	zero	15
Radium-226	zero	20
Radium-228	zero	20
Radon-222	zero	300
Uranium	zero	30 (20 μg/L)
Beta Particle & Photon Emitters	zero	4 mrem+

* Adjusted gross-alpha particle activity, excluding radium-226, uranium, and radon-222. (The radon-222 will not be subtracted as it will be eliminated from the sample due to handling procedures.)

+ The average annual concentration of beta particle and photon radioactivity from all man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/year. Compliance with this standard is assumed if the gross-beta activity does not exceed 50 pCi/L, and if the concentrations of tritium or strontium-90 do not exceed the 20,000 or 8 pCi/L, respectively. If both tritium and strontium-90 are present, the sum of their annual dose equivalents cannot exceed 4 mrem/year.

(2) All systems must monitor for radium-226, radium-228, uranium, and adjusted gross-alpha emitters annually, unless waived by the State. Gross-alpha monitoring is used as a screen for radium-226 and uranium. If the concentration of gross-alpha activity does not exceed the MCL of either radium-226 or uranium, compliance is assumed for all three parameters.

(3) Systems using only surface water would not be required to monitor for radon. Systems using ground water in whole or in part must monitor for radon quarterly for 1 year and then annually if results allow. Systems which use ground water to occasionally supplement a surface water source would monitor only during those periods of ground-water use.

(4) All systems will be required to take part in a one-time monitoring event for lead-210. This would allow EPA to build its available data on occurrence of lead-210 to determine if it warrants a public health concern.

4-11. Information Collection Rule - 59 FR 6332

a. *General.* Disinfectants have long been used to control microbial risks in drinking water. Unfortunately, the disinfectants themselves also pose some risk in drinking water. When in the presence of organic matter called precursors, the disinfectants react to form disinfection by-products (DBPs). DBPs have been associated by many studies with increased cancer risk. Controlling the risk of these DBPs without jeopardizing the microbiological integrity of drinking water became a large task for the EPA. The end result of months of negotiation between regulatory officials, environmentalists, public health officials and consumer advocates -- i.e., a "reg-neg" process -- was a group of three rules: the Information Collection Rule (ICR), the DDBP Rule, and the Enhanced Surface Water Treatment Rule (ESWTR). The ICR was proposed on February 10, 1994. Its purpose is to gather data on DBPs and microbiological organisms (*Giardia*, viruses and the currently unregulated *Cryptosporidium*) necessary to properly regulate disinfectants and DBPs and strengthen microbial control of drinking water.

b. *Systems Affected.* As proposed, the ICR will apply to all CWSs and NTNC water systems that meet any of the following criteria:

(1) Systems using surface water as a source (including GWUDI) and serving at least 10,000 people.

(2) Systems using ground water as a source and serving at least 50,000 people.

(3) Systems with an average daily flow of greater than 9 million gallons per day.

c. *Standards.* The ICR will not legislate any drinking water standards. Instead the rule requires affected systems to monitor and perform pilot or bench-scale studies in order to gather occurrence and treatment data for certain microbiological contaminants and DBPs. This data will be used in the development of the second stage of the DDBP Rule and the ESWTR. Specific parameters to be monitored and pilot/bench-scale study requirements are outlined in Table 4-16.

d. *Monitoring.* Monitoring schedules and frequencies are dependent upon system size. Exact monitoring deadlines are dependent upon promulgation of the final rule, which is currently scheduled for late 1995. Systems serving 100,000 people or more will monitor for 18 consecutive months. Systems serving 10,000 to 99,999 people must monitor bimonthly for 12 months. Sampling for microbiological parameters is complex and will require extensive effort and time. Specific sampling techniques contained in the proposed ICR will have to be used.

e. *Data Submission.* Since the States will not assume primacy for the ICR, systems will report directly to the EPA. Systems should contact their EPA regional office of drinking water to determine whether or not they are responsible to complete the monitoring under the ICR.

TABLE 4-16. ICR REQUIREMENTS

Requirements	1	2	3	4
Monitor for Giardia, Cryptosporidium, fecal coliform or E. coli, and total coliforms	•	•		
Monitor for total "culturable" viruses		•		
Monitor finished water for Giardia, Cryptosporidium, and viruses if detected above 1/L in raw water		•		
Monitor for disinfection by-products and related water quality parameters		•		•
Monitor for total organic carbon only			•	
Provide treatment plant data regarding design/treatment processes	•	•		
Provide treatment plant data regarding removal of disinfection by-products		•		•
Bench or pilot scale studies to determine optimal disinfection by-product precursor removal		•	•	•

1= systems using surface water (sw) or ground water under the direct influence (GWUDI) of surface water and serving between 10,000- 100,000 people
2= systems using sw or GWUDI and serving $\geq$100,000 people
3= systems using ground water (gw) and serving between 50,000-100,000 people
4= systems using gw and serving $\geq$100,000 people

4-12. Disinfectants and Disinfection By-Products Rule - 59 FR 38668

a. *Systems Affected.* The proposed DDBP Rule will apply to all CWSs and NTNC systems that use a chemical disinfectant. All TNC systems using chlorine dioxide will be required to comply with its maximum residual disinfectant limit of 0.8 mg/L.

b. *Standards.* The DDBP Rule is divided into two stages. The two stages are aimed at "easing" systems into compliance with lower MCLs, while giving the EPA enough to time to determine if the lower MCLs are beneficial. Stage 1 was proposed on 29 July 1994. Stage 2 should be proposed sometime in 1998. The proposed Stage 1 sets new MCLs for previously unregulated DBPs, as well as lowers the current MCL for TTHMs. It also sets maximum residual disinfectant levels (MRDLs) for common disinfectants, such as chlorine and chlorine dioxide. Tables 4-17 and 4-18 list the proposed limits.

TABLE 4-17. PROPOSED DDBP MCLs

Contaminant	MCLG (mg/L)	MCL (mg/L)
Total trihalomethanes	N/A*	0.080
Haloacetic acids (HAA5)	N/A+	0.060
Chloroform	0	N/A*
Bromodichloromethane	0	N/A*
Dibromochloromethane	0.06	N/A*
Bromoform	0	N/A*
Dichloroacetic acid	0	N/A+
Trichloroacetic acid	0.3	N/A+
Chloral hydrate	0.04	N/A≠
Chlorite	0.08	1.0
Bromate	0	0.010

* Total trihalomethanes (TTHM) are the sum of the concentrations of bromodichloromethane, dibromochloromethane, bromoform, and chloroform.

\+ Haloacetic acids (HAA5) are the sum of the concentrations of mono-, di-, and trichloroacetic acids and mono- and dibromoacetic acids.

≠ EPA did not set an MCL for chloral hydrate because the TTHM and HAA5 MCLs and the treatment technique (i.e., enhanced coagulation) for disinfection byproduct precursor removal will provide sufficient control for chloral hydrate.

TABLE 4-18. DISINFECTANT MRDLs

Disinfectant	MRDLG (mg/L)	MRDL (mg/L)
Chlorine	4 (as Cl_2)	4.0 (as Cl_2)
Chloramines	4 (as Cl_2)	4.0 (as Cl_2)
Chlorine Dioxide	0.3 (as ClO_2)	0.8 (as ClO_2)

c. *Treatment Requirements*. To further control DBPs, the proposed DDBP Rule imposes treatment techniques to reduce DBP precursors, measured as total organic carbon (TOC). Surface water systems and GWUDI, as defined by the SWTR, using conventional treatment will be required to use enhanced coagulation or enhanced softening to remove TOC. Percent TOC reductions required are based upon source water concentrations and alkalinity. The reduction must occur prior to the point of continuous disinfection. Systems using ozone followed by biological filtration or chlorine dioxide must meet reduction requirements prior to the addition of residual disinfectant. Table 4-19 contains the percent reductions required. Systems can avoid enhanced treatment requirements if one of the following conditions is met:

TABLE 4-19. TOC REDUCTIONS REQUIRED

	Source Water Alkalinity		
	0-60	>60-120	>120*
Source Water TOC	% TOC Removal Required		
>2.0-4.0	40.0	30.0	20.0
>4.00-8.0	45.0	35.0	25.0
>8.0	50.0	40.0	30.0

* Systems using enhanced softening must meet the TOC removal percentages in this column.

(1) The system's treated water TOC level, prior to continuous disinfection, is less than 4.0 mg/L, the alkalinity is greater than 60 mg/L and the system's TTHM and HAA5 concentrations are no more than 50 percent of the Stage 1 MCLs or the system has made a clear and irrevocable financial commitment by the DDBP effective date to employ technologies which will ensure TTHM and HAA5 levels are no more than 50 percent of the Stage 1 MCLs;

(2) the system uses chlorine for disinfection and the annual average of TTHM and HAA5 concentrations are still no more than 50 percent of the MCLs; or

(3) the system practices softening (other than ion exchange) and removes at least 10 mg/L of magnesium hardness (as $CaCO_3$).

d. *Operator Certification.* The proposed DDBP Rule requires each PWS to be operated by personnel properly certified by the State in which the system is located. States that do not have specific operator qualifications must develop them. All States must maintain a register of qualified/certified operators.

e. *Monitoring and Compliance Determinations.* Monitoring for the disinfectant residuals and DBPs regulated by Stage 1 of the DDBP Rule is dependant upon the disinfectant used. Table 4-20 summarizes the proposed routine monitoring requirements. Systems serving more than 10,000 people must begin to monitor for the new DBP requirements within 18 months after finalization of the Stage 1 DDBP Rule. Systems serving less than 10,000 people have 42 months after finalization of the Stage 1 DDBP Rule to begin compliance monitoring. Reduced monitoring for TTHMs and HAA5 is allowed for systems whose annual average concentrations are no more than half of the Stage 1 MCLs for one complete year under the routine monitoring schedule and whose source water TOC is no more than 4.0 mg/L prior to treatment. Ground-water systems serving less than 10,000 people are not eligible for reduced monitoring for TTHMs and HAA5 until meeting the above criteria for 2 years of routine monitoring. They may reduce after 1 year if TTHM and HAA5 concentrations are no more than 0.020 mg/L and 0.015 mg/L, respectively. Compliance with the TTHM and HAA5 MCLs is based upon an RAA of sample results. Reduced monitoring for chlorite is not allowed. Compliance with the chlorite MCL is based upon a monthly average. Systems using ozone may reduce monitoring for bromate to once per quarter if the average raw water bromide concentration is below 0.05 mg/L (based upon 12 consecutive monthly measurements).

TABLE 4-20. MONITORING REQUIREMENTS OF THE PROPOSED DDBP RULE

(From the 59 FR 38668, 29 July 1994)

Contaminant	Location for Sampling	Large Surface Systems (1)	Small Surface Systems (1)	Large Ground Systems (2)	Small Ground Systems (2)
TOC	Paired Samples (3) – Only required for plants with conventional treatment	1 paired sample/month/ plant	1 paired sample/month/ plant	N/A	N/A
TTHMs	25% in dist sys at max residence time, 75% at representative locations	4/plant/quarter	1/plant/quarter (6) at max residence time if pop. <500, then 1/plant/yr (7)	1/plant/quarter (6) at maximum residence time	1/plant/yr (6) (7) at max residence time during warmest month
HAA5	See TTHMs.	See TTHMs.	See TTHMs.	See TTHMs.	See TTHMs.
Bromate (4)	Dist sys entrance point	1/month/plant using ozone	1/month/plant using ozone	1/month/plant using ozone	1/month/plant using ozone
Chlorite (5)	1 near first cust, 1 in dist sys middle, 1 at max res time	3/month	3/month	3/month	3/month
Chlorine	Same points as coliform in TCR	Same times as coliform in TCR	Same times as coliform in TCR	Same times as coliform in TCR	Same times as coliform in TCR
Chlorine Dioxide (5)	Entrance to dist sys	Daily/plant using ClO2	Daily/plant using ClO2	Daily/plant using ClO2	Daily/plant using ClO2
Chloramines	Same points as coliform in TCR	Same times as coliform in TCR	Same times as coliform in TCR	Same times as coliform in TCR	Same times as coliform in TCR

(1) Large surface (including GWUDI as defined by the SWTR) systems serve 10,000 or more persons. Small surface systems serving fewer than 10,000 persons.

(2) Large systems using ground water not under the direct influence of surface water serve fewer than 10,000 persons. Small systems using ground water not under the influence of surface water serve fewer than 10,000 persons.

(3) Surface water systems which use conventional filtration treatment must monitor 1) source water TOC prior to any treatment and 2) treated TOC before continuous disinfection (except that systems using ozone followed by biological filtration may sample after biological filtration) at the same time; these two samples are called paired samples.

(4) Only required for systems using ozone for oxidation or disinfection.

(5) Only required for systems using chlorine dioxide for oxidation or disinfection. Additional chlorine dioxide monitoring requirements apply if any chlorine dioxide sample exceeds the MRDL.

(6) Multiple wells drawing water from a single aquifer may, with State approval, be considered one treatment plant for determining the minimum number of samples.

(7) If the annual monitoring result exceeds the MCL, the system must increase monitoring frequency to 1/plant/quarter. Compliance determinations will be based on the running annual average of quarterly monitoring results.

4-13. Enhanced Surface Water Treatment Rule - 59 FR 38832

a. *General.* Of the three rules passed as a result of the negotiating process to regulate DBPs without sacrificing control of microbial contaminants, the ESWTR, proposed on July 29, 1994, remains the most sketchy. The proposed rule provides several treatment options under consideration, the best of which or combination thereof will be chosen for the final interim rule based upon monitoring results collected under the ICR. The rule addresses not only the possibility of more strict regulations for *Giardia* and viruses, but also regulates *Cryptosporidium*. Although recognized as a human pathogen since 1976, its inability to be easily detected made *Cryptosporidium* difficult to regulate. Recent outbreaks of Cryptosporidiosis and increasing concern for the impacts on consumers with suppressed immune systems caused the recent push to ensure regulatory criteria for *Cryptosporidium* in public water supplies.

b. *Systems Affected.* The ESWTR will apply to surface water systems and GWUDI systems. The definition of GWUDI will be similar to that given in the SWTR, with the addition of *Cryptosporidium* presence as an indicator of surface water influence. The interim ESWTR, to be promulgated in December 1996, will apply to the above systems that serve 10,000 people or more. The rule will apply to those systems serving fewer than 10,000 people after its re-examination and finalization by June 2000.

c. *Standards.* The proposed ESWTR establishes water quality criteria for controlling *Cryptosporidium* in drinking water. It may strengthen treatment requirements for removal/inactivation of *Giardia* and viruses by the time it is finalized. The rule proposes an MCLG of zero for *Cryptosporidium*. Since the analytical technique for *Cryptosporidium*, like *Giardia* and viruses, is difficult and unreliable, the rule proposes several treatment options rather than an MCL for *Cryptosporidium*. The proposed rule adds to the requirements of the original SWTR with an expanded watershed control program in order for systems to continue to avoid filtration; a 99 percent removal of *Cryptosporidium* requirement for alternative filtration technologies originally approved under the existing SWTR, and mandatory sanitary surveys for all regulated systems regardless of whether or not they filter. Additional proposed requirements include covering of finished water reservoirs, mandatory cross-connection control programs, and additional State notification when turbidity levels rise above performance standards (0.5 or 1.0 NTU, depending upon filtration used).

d. *Treatment Options.* The treatment options proposed under the ESWTR may supplement or increase the treatment requirements of the SWTR. The option chosen for the final rule will depend upon the source and resulting finished water concentrations of *Giardia*, viruses, and *Cryptosporidium* after treatment under the existing SWTR. If finished water qualities indicate that the treatment required under the SWTR is sufficient to remove/inactivate enough *Giardia* and viruses to be protective of health, and that the same

treatment is also sufficient to remove/inactivate *Cryptosporidium* to a protective level, then the ESWTR may not make any changes to the existing treatment requirements for surface water and GWUDI systems. The proposed treatment options are shown in Table 4-21. Note for alternatives A-D, States would need to develop and enforce specific design and operating criteria for achieving the removal or inactivation required; the ESWTR did not specify treatment technologies or design CT tables as in the SWTR.

TABLE 4-21. PROPOSED ESWTR TREATMENT OPTIONS

(From the SDWA Advisor)

Alternative	Criteria for	Systems serving <10,000	Systems serving ≥10,000	
			Source water Cyst/Oocyst Concentration	Log Removal Required
A	Giardia	3-log*	<1 cyst/100L 1-9 cysts/100L 10-99 cysts/100L >99 cysts/100L	3-log 4-log 5-log 6-log
A+	Giardia	3-log	10-99 cysts/100L 100-999 cysts/100L ≥1000	4-log 5-log 6-log
B	Crypto	3-log	<1 oocyst/100L 1-9 oocysts/100L 10-99 oocysts/100L >99 oocysts/100L	3-/2-log 4-/3-/2-log‡ 5-/4-3-log‡ 6-/5-/4-log‡
C	Crypto for filtering systems only	Systems that filter must achieve at least 2-log removal of Cryptosporidium between source water and the first customer.		
D	Giardia	N/A	Systems must achieve at least 0.5-log inactivation of Giardia (alternative: 4-log inactivation of viruses) by disinfection alone.	
E	–	No change to existing SWTR removal/inactivation requirements.		

* 2-log = 99%, 3-log = 99.9%, 4-log = 99.99%, 5-log = 99.999%, 6-log = 99.9999%

\+ An alternative version of Alternative A under consideration, requiring greater Giardia reductions for source waters beginning with Giardia concentrations of 10 or more cysts/100 liters.

‡ Second and third values are alternative removals being considered by the EPA.

4-14. Ground-Water Disinfection Rule

a. *Systems Affected.* The SDWA Amendments of 1986 required that all PWSs be disinfected. The SWTR established this requirement for PWSs using surface water or GWUDI. The draft Ground-Water Disinfection Rule (GWDR) released on June 20, 1991 establishes disinfection criteria for the remainder of the PWSs -- those using ground water not under the direct influence of surface water. When finalized, the GWDR will apply to all CWSs and NTNC water systems.

b. *Standards.* Like the SWTR, the GWDR will regulate microbial quality via minimum disinfection criteria (treatment techniques), rather than MCLs. Systems can avoid chemical disinfection treatment if they can prove that the ground water undergoes natural disinfection. The EPA is contemplating setting MCLGs for viruses and *Legionella*, both at zero. Minimum disinfection criteria will be set using minimum inactivation of viruses and by setting a 0.2 mg/L residual requirement for water entering the distribution system. Exact inactivation levels will be publicized in the proposed rule. To ensure that systems (each well) are achieving the minimum inactivation levels, the GWDR will require all wells to meet State determined design and operating criteria and may require CT (see SWTR, section 4-6f) calculations for each well. Disinfection with ultraviolet light (UV) will be allowed, provided that systems install UV sensors and recorders at each application point to indicate that the systems is providing the minimum UV dosage to be specified in the proposed rule.

c. *Natural Disinfection Criteria.* Systems desiring to avoid applying disinfection treatment must demonstrate that the aquifer from which their ground water is supplied provides natural disinfection. Additional criteria under consideration that would have to be met for systems to avoid disinfecting are similar to those required to avoid filtration under the SWTR. They are shown in Table 4-22. Natural disinfection criteria are listed in Table 4-23.

TABLE 4-22. POSSIBLE CRITERIA FOR AVOIDING DISINFECTION

Well	System
1) Never been identified as a source of waterborne disease, as currently constructed	1) In compliance with the Total Coliform Rule
2) Meets State-approved well construction codes	

TABLE 4-23. POSSIBLE NATURAL DISINFECTION CRITERIA

Criteria A)	- the nearest potential source of fecal contamination (to include surface water) is a specified minimum distance from the well - the water must not flow through caves, large fractures, or other similar geological features
Criteria B)	- the travel time of a ground water particle (not considering effects of retardation, dispersion, or diffusion) taking the most direct path is a specified minimum number of days from the nearest potential source of fecal contamination to the well
Criteria C)	- the travel time of a microbial pathogen (including the effects of retardation, dispersion, inactivation and diffusion) taking the most direct path is a specified minimum number of days from the nearest potential source of fecal contamination to the well
Criteria D)	- the travel time of a microbial pathogen (including the effects of retardation, dispersion, or diffusion) taking the most direct path is a specified minimum number of days from the nearest potential source of fecal contamination to the well
Criteria E)	- a hydrogeologic feature, such as a thick unsaturated zone, controls potential contaminant flow to the well, and human activities do not adversely affect the integrity of this feature

d. *Operator Certification.* The proposed GWDR will impose requirements for operators to be properly certified by the State. First it may require that all systems that use ground water and use a disinfectant other than sodium hypochlorite be operated by certified personnel, require that only CWSs that disinfect their water be operated by certified personnel, or that all CWSs be operated by certified personnel, regardless of whether or not they disinfect. Due to qualified operator requirements of the DDBP Rule, it appears that all systems which disinfect will eventually be operated by certified personnel.

4-15. Sulfate - 59 FR 65578

a. *General.* An MCL was first proposed for sulfate in the Phase V package of SOCs and inorganic chemicals (IOCs). However, the health effect (diarrhea) associated with drinking high levels of sulfate is acute and temporary and affects only those not acclimated to such levels. The available health data do not indicate any health effects from chronic exposure to sulfate. A strict regulation for such a contaminant would not provide a uniform benefit to consumers and therefore was debated. The EPA did not finalize the MCL for sulfate in the Phase V package and instead worked on a more flexible regulation for sulfate tailored to the target populations (infants up to 12 months of age, transients, and new residents). The sulfate MCL and related NPDWR requirements were reproposed on 20 December 1994.

b. *Systems Affected.* As proposed, the new sulfate regulations will apply to all PWSs, to include TNC systems used by transients.

c. *Standards.* The proposed MCLG and MCL for sulfate are both set at 500 mg/L. The regulation includes several compliance alternatives to centralized treatment for meeting the MCL. Options include combinations of public education and provision of alternative water supplies to target populations. Alternative water supplies would include bottled water (which meets all EPA standards) and point-of use/point-of-entry (POU/POE) devices. This override of the general prohibition in 40 CFR 141.101 on using bottled water and devices for compliance with an MCL would apply for the sulfate regulation only.

d. *Compliance Options.*

(1) Option 1. Option 1 would allow PWSs to comply with the sulfate MCL by using conventional central treatment or by providing alternative water (bottled water meeting all EPA standards or POU/POE devices) to target populations. All PWSs choosing to supply alternative water must also provide a public education/notification program. Transient PWSs could substitute the posting of signs in lieu of a public education program. All systems would be responsible for ensuring that public notification was posted in all areas where travelers and new residents may obtain drinking water. If the location was equipped with a POE device to meet the sulfate MCL, a posted notice would not be required. The option sets specific time limits on the provision of alternative water to target consumers, allowing adequate time for their digestive systems to adjust to the higher levels of sulfate in the tap water. The proposed rule prohibits PWSs from charging target consumers a premium for alternative water.

(2) Options 2 and 3. Option 2 differs from Option 1 in that the target population requiring alternative water would only include infants up to 12 months of age. Under this option, the EPA considered the temporary diarrhea experienced by adult transients and new residents as an inconvenience rather than a health threat. Option 3 differs from Option 2 in that it would also require PWSs to notify adult transients and new residents of the potential adverse effects from elevated sulfate levels, but still would not require alternative water to be provided for such consumers.

(3) Option 4. Option 4 would present the same alternatives as Option 1, but would require PWSs using alternative water as a means of compliance to obtain a variance from the State. This would increase the State's oversight and would require the State to perform an assessment of any unreasonable risks to health.

e. *Monitoring*. Monitoring for sulfate would follow the Standardized Monitoring Framework. Initial monitoring for all systems would begin in the first January after the effective date of the final rule. Systems would be required to take a minimum of one sample at every entry point to the distribution system which is representative of each well or source after treatment. Surface water systems would be required to sample annually and ground water systems once every 3 years. Systems choosing to supply alternative water would not be required to continue monitoring for sulfate as long as the alternative water is provided.

CHAPTER 5
NATIONAL SECONDARY DRINKING WATER REGULATIONS

5-1. Standards

The NSDWR are standards for substances that impact the aesthetic quality of drinking water (taste, odor, appearance, cosmetic effects on plumbing fixtures and clothes). They are reflected in 40 CFR 143. Table 5-1 contains a list of the NSDWR parameters and their SMCLs.

5-2. Applicability

The NSDWR are not Federally enforceable. They are suggested guidelines for producing water acceptable to consumers. Some States enforce the NSDWR in the consumer's best interest. Installations must be aware of State limits and monitoring requirements for these parameters.

TABLE 5-1. SECONDARY MAXIMUM CONTAMINANT LEVELS

Parameter	SMCL, mg/L
Aluminum	0.05-0.2
Chloride	250
Color	15 color units
Corrosivity	Non-corrosive
Fluoride	2.0
Foaming agents	0.5
Iron	0.3
Manganese	0.05
Odor	3 threshold odor
pH	6.5-8.5
Silver	0.1
Sulfate	250
Total dissolved solids	500
Zinc	5

CHAPTER 6
RECORDKEEPING AND REPORTING

6-1. Recordkeeping - 40 CFR 141, Subpart D

a. *Requirements*. The SDWA requires purveyors of public water to maintain records of water quality analysis results and actions taken pertaining to the drinking water system. Such installation records should be kept by the DPW or DEH, the installation environmental office and/or other designated offices such as the IMA or PVNTMED. Table 6-1 summarizes the recordkeeping schedule mandated by the SDWA. The records must include the date, place, and time of sampling, the name of the person taking the sample, the type of sample (routine, confirmatory or special), the date of analysis, the laboratory name and identification number, name(s) of analyst(s), analytical methodology, and the results.

b. *Value of Well-Kept Records*. A well-kept set of records is useful to monitor the progress of a system during new treatment initiatives, to monitor the changes in source water quality, and to ensure the continuing adequacy of a treatment system. Records are necessary for the application for waivers and for compliance. Records may also be a very important part of litigation matters.

TABLE 6-1. RECORDKEEPING REQUIREMENTS

Contaminant Group / Action	Years to be Kept
Microbiological	5
Chemical	10
Records of action to correct violations	3
Sanitary survey reports	10
Records of variance/exemption	5*
Lead and Copper Rule monitoring results	12

* Five years after expiration date of variance/exemption.

6-2. Reporting - 40 CFR 141, Subpart D

All regulatory monitoring results must be reported to the State. The specific information to be reported and the time in which it must be reported to the State is dependent upon the contaminant group or rule. Typically, the system must report the monitoring results within the first 10 days of the month in which the analytical results are received or within 10 days

following the end of a monitoring period, whichever is earlier. If an MCL is exceeded or if a monitoring requirement is missed, the State must be notified within 48 hours. Special reporting requirements with often shorter suspense exist for the TCR, the SWTR, and the Lead and Copper Rule. These requirements are summarized separately in Chapter 4.

CHAPTER 7
PUBLIC NOTIFICATION - 40 CFR 141, Subpart D

7-1. Purpose

The purpose of public notification is not only for compliance, but is to protect the health of the consumer. This is the heart of the SDWA since that is the mission of the legislation -- to ensure the safety of the consumer. Sometimes, the drinking water produced does not meet the criteria to be considered safe, as determined by the regulations of the SDWA. In these cases, the consumer must be notified of the concern and what he can do to protect himself. The EPA has established the public notification criteria for all SDWA violations.

7-2. Types of Violations

Since the regulations of the SDWA range from protection of health (compliance with MCLs and treatment techniques) to administrative requirements (monitoring at certain times, issue of variance and exemptions, use of particular analytical techniques), the public notification requirements divide SDWA violations into two tiers. Tier 1 violations may affect the health of the consumer and therefore have more stringent notification requirements. These notifications must use certain verbiage called "mandatory health effects language." The language for each contaminant regulated by the EPA is found in 40 CFR 141. Tier 2 violations are less acute and have less stringent public notification requirements.

7-3. General Content and Distribution of Public Notice

The EPA requires certain information to be included in all public notices, such as mandatory health effects language for Tier 1 violations, the phone number of a point of contact regarding the issue, and what the system is doing to correct the problem. The format of the notification must meet certain specifications, designed to be useful to the majority of the population served. The media type used and the frequency of distribution is also governed. Figure 7-1 contains the basic notification requirements, but the EPA guidance manual, General Public Notification for Public Water Systems, or the 40 CFR 141, Subpart D should be consulted when confronted with any public notification requirements.

Figure 7-1. Summary of Public Notification Requirements

(Source: General Public Notification For Public Water Systems, EPA Doc. No. 570/9-89-002, September 1989.)

Summary of Public Notification Requirements

Public Notification Requirements

Violation Category Type	Mandatory Health Effects Information Required (All PWSs)	Notice to New Billing Units (CWSs Only)	Type of PWS	Time Frame Within Which Notice Must be Given (Box indicates time frame for initial notice, and is followed by the frequency of repeat notice until the violation is resolved)
				Violation / 72 hours / 7 days / 14 days / 45 days / 3 months / Annual
TIER 1			Community	Acute Violations:
1. MCL	Yes	Yes		TV and Radio — No Repeat
2. Treatment Technique	Yes	Yes		Newspaper[1] — No Repeat
3. Variance or Exemption Schedule Violation	Yes	Yes		Mail or Hand Delivery[2] — Quarterly Repeat
				Non-Acute Violations:
				Newspaper[1] — No Repeat
				Mail or Hand Delivery[2] — Quarterly Repeat
			Non-Community[3]	Option 1: Notice as for Community Water Systems or Option 2: Acute Violations: Posting or Hand Delivery — Continuous/Quarterly Repeat[5]
				Non-Acute Violations:
				Posting or Hand Delivery — Continuous/Quarterly Repeat[5]
TIER 2			Community	Newspaper[1] — Quarterly Repeat by Mail or Hand Delivery
1. Monitoring[4]	No	No		
2. Testing Procedure	No	No		
3. Variance or Exemption Issued	Yes	No	Non-Community[3]	Option 1: Notice as for Community Water Systems or Option 2: Posting or Hand Delivery — Continuous/Quarterly Repeat[5]

Footnotes

[1]If no newspaper of general circulation is available, posting or hand delivery is required as specified in §141.32(a)(3)(i) and §141.32(b)(3)(i).

[2]May be waived in accordance with §141.32(a)(1)(ii).

[3]Includes both transient non-community public water systems and non-transient non-community public water systems.

[4]Less frequent notice (but no less than annual) to be required as in §142.16(a).

[5]Continuous repeat required if posting is used; quarterly repeat required if hand delivery is used.

CHAPTER 8
IMPACT OF SDWA REGULATIONS ON THE U.S. ARMY

8-1. General

Present and future drinking water regulations will have a significant impact on the U.S. Army. The Major Army Commands (MACOMs) and Army installations can initiate several actions to get ready for the various new SDWA regulatory requirements. The primary impact is the increasing demand on dollars and manpower. An exact dollar figure cannot be given; however, it can readily be seen that there will be a significant increase in cost for carrying out the provisions of the SDWA. For example, it will cost more to contract out analyses in the future when more regulated and numerous unregulated contaminants are required to be monitored. Rules like the Lead and Copper Rule and the proposed ICR include extensive monitoring. Treatment options to provide water of the required quality may require additional capital costs in water treatment plant improvements, necessitating new Military Construction, Army (MCA) or Operations & Maintenance, Army (OMA) projects.

8-2. Manpower

Added requirements for manpower can be attributed to increased sample collection, increased reporting requirements, and increased demands from additional environmental protection requirements, such as the ground-water protection programs. Installation monitoring requirements must be clearly defined since they are based on many factors, namely the type of system, population served, and the water source. To ensure compliance with monitoring requirements, Army installations should contact the State.

CHAPTER 9
OPERATION AND MAINTENANCE

9-1. General

There are five common barriers used in providing safe drinking water to protect the consumer from contaminants: water source protection, effective treatment processes, proper operation of the distribution system, monitoring, and adequate staffing/training for water works. It is understood that in each water system some barriers will have to be strengthened to make up for weaker barriers which may not be as easily controlled. For example, a system which may not have control over its poor quality watershed may have to improve water treatment processes. Proper operation of the distribution system, however, is one barrier that if not properly enforced, can diminish the returns of all other barriers. No matter how good the quality of water is coming out of a treatment plant, if the distribution system through which the water is piped is not well maintained, the consumer has no guarantee of consistently safe and pleasing drinking water. The key to keeping a water distribution system in good working order is a set of sound and exercised O&M practices. Many States require and enforce particular O&M practices, such as flushing and maintenance of a minimum pressure within the distribution system. These requirements must be met by all Army installations to remain in compliance with State drinking water regulations. The TCR lists several distribution system O&M techniques as best management practices for remaining in compliance with the rule (see paragraph 4-5f). However, O&M practices are often the first to be abandoned when resource reductions (financial or labor) are imposed upon a water system. The USACHPPM has noted many common deficiencies in CONUS & OCONUS waterworks systems in the course of performing periodic onsite consultations and environmental assessments. Typical deficiencies have been the lack of effective flushing programs, inadequate disinfection of repaired depressurized mains, ineffective or absent cross-connection control programs, and the absence of contingency plans. In many cases, it has taken the occurrence of a drinking water contamination episode to force systems to correct such deficiencies.

9-2. Common Operation and Maintenance Concerns.

a. *General.* The most common O&M practices are linked to the distribution system. However, a PWS cannot overlook the routine O&M practices that occur within the water treatment plant itself, such as pump testing and facility/equipment inspections. The paragraphs below briefly discuss the most common O&M practices. State regulations should be consulted to ensure compliance with any mandatory O&M requirements.

b. *Flushing*. Perhaps the most simplistic and easily implemented O&M practice is routine, effective flushing of the water distribution system. It also results in the most improved water quality, for the effort required, by minimizing the potential for water in the distribution system to become stagnant and degrade in quality. Flushing may also greatly reduce consumer complaints. Consideration must be given to both the order in which distribution system mains are flushed and the velocity at which they are flushed in order for flushing to be effective. Proper flushing must be performed systematically beginning with the mains closest to the treatment plant and working toward the outermost mains of the distribution system. Without careful consideration to the order of flushing the mains, poor quality water from one area of the distribution system may just end up in another area of the system. Flushing velocities must be great enough to completely dislodge and dispel any loose particles and biofilm growth in the distribution mains. TB MED 576 recommends a minimum flushing velocity of 2.5 feet per second. Flushing programs should be performed at least annually, semiannually or more frequently if distribution system water quality warrants.

c. *Maintenance of a Disinfection Residual*. Future regulations will force water systems to establish a balance between the risks of microbial contamination and DBPs formation. However, the protection of the consumer from microbiological contamination entering the distribution system must not be compromised. Microbial contamination can enter a distribution system (well after treatment) through cross-connections and broken/depressurized water mains. To protect consumers from any microbes, if pathogenic, a detectable disinfectant residual (generally considered to be $\geq$0.2 mg/L) should be maintained at all times throughout all portions of the distribution system. A disinfectant residual can be maintained through the system by increasing the residual leaving the plant or by frequently flushing low flow areas of the distribution system where long retention times often result in dissipated disinfectant residuals. The SWTR mandates the presence of a disinfectant residual in all regulated systems. The GWDR, when finalized, will have a similar requirement. The TCR lists the presence of a disinfectant residual as a best management practice to ensure compliance with the rule (see paragraph 4-5f). The disinfectant residual can help to eliminate the effects of non-pathogenic biofilm which often grows in distribution pipes and can trigger positive total coliform monitoring results, often resulting in non-compliance with the TCR.

d. *Disinfection of Repaired Depressurized Mains*. Broken water mains create two separate and distinct concerns. First, the broken main translates to loss of drinking water service for one to several buildings. This creates a concern for providing the proper "quantity" of drinking water. Secondly, the water that is provided after the main has been repaired must be safe and free from any contaminants (typically microbiological) which may have entered the broken line before or during the repair. This translates to a concern for "quality" of drinking water. Both are important and neither concern should be sacrificed to

solve the other. Too often are broken depressurized drinking water mains put back into service in order to solve a water quantity crisis. Prior to putting such mains back into service, it is imperative that they be properly flushed, disinfected, reflushed and sampled to ensure the microbiological integrity of the water supplied to the consumer. TB MED 576 requires that all repaired depressurized and new drinking water mains be properly flushed, disinfected, and sampled for microbiological integrity. TB MED 576 also provides some guidance on how to properly perform these procedures. The American Water Works Association (AWWA) Standard No. C651-92, Disinfecting Water Mains, provides detailed guidance on disinfecting and flushing repaired/new mains as well as disposing of superchlorinated water from disinfected mains. The AWWA standards can be obtained from the AWWA, 6666 West Quincy Ave., Denver, CO 80235.

e. *Maintenance of a Positive Pressure.* One of the most effective ways to protect distributed drinking water from cross-connection contamination is to maintain a positive pressure at all points throughout the distribution system. When pressures drop sufficiently or are reduced to a vacuum, pressures of cross-connected non-potable fluids can force contaminants into the drinking water lines if the connection is not protected by an appropriate cross-connection control device. A positive pressure can also reduce the chances of contaminants entering drinking water lines through cracks and small breaks. For these reasons, many States require that PWSs maintain a minimum pressure in all parts of the distribution system at all times. Design for minimum pressures should take into account maximum hourly demand. Operating pressures may range anywhere from 30-110 pounds per square inch (psi). Pressures over 110 psi should be controlled with pressure reducing valves to protect distribution system lines and consumer plumbing fixtures. Optimal operating pressure is typically maintained through a combination of storage tanks, booster pumps and pressure reducing valves. Water distribution system pressures should be routinely monitored. They are often monitored by the fire department, either continually as part of the fire protection program or routinely as part of a hydrant testing program. Pressure checks can also be included as a part of the distribution system flushing program.

f. *Cross-Connection Control.* A cross-connection is any physical connection between a potable water supply and a non-potable material. Cross-connections can cause major health risks if contamination should enter the potable water system undetected. They should be eliminated if at all possible. The best protection against non-potable materials entering the potable water distribution system is to physically separate the two systems. However, this is not always possible, since many machines and processes require a continual supply of water while operating. Such connections should be protected using appropriate back-flow prevention devices. These devices allow water to flow only from the potable water side of the connection and prohibit flow in the reverse direction. Many States require PWSs to establish an active cross-connection control program. This entails taking an inventory of all cross-connections in the distribution system, installing the correct protective device, testing

the devices annually to ensure proper operation, and replacing devices as necessary. This type of program is included as best management practice for compliance with the TCR (see paragraph 4-5f). The EPA has produced a guidance manual that describes common cross-connections, illustrates the potential threat of such connections, and provides an example of how to begin a cross-connection control program. The manual is entitled, Cross-Connection Control Manual, EPA 570/9-89-007. Additional cross-connection references can be found in Appendix A.

g. *Sanitary Surveys*. Sanitary surveys are defined in Army TGs as the onsite review of the water source and surroundings, facilities, equipment, O&M of a PWS for the purpose of evaluating their adequacy for producing and distributing safe drinking water. The SWTR requires applicable systems that do not filter to perform annual onsite inspections of their watershed control program and disinfecting facilities. This inspection is not quite as rigorous as a full-scale sanitary survey. The ESWTR, as proposed, will require all regulated systems (surface water and GWUDI) to perform full-scale sanitary surveys. States may have more stringent requirements for such surveys. The importance of a sanitary survey is the recognition of weaknesses within a system before they present a problem. A sanitary survey is a self-assessment for a PWS and can also aid in recognizing funding requirements. Even if not required by regulations, PWSs should consider performing a sanitary survey every few years to maintain a working knowledge of how the system works and to identify areas for improvement. All PWSs should strive to ensure the health and approval of the consumer rather than mere compliance. There may be many unregulated irregularities within a PWS that pose a threat to consumer health which would otherwise not be discovered.

h. *Contingency Planning*. A contingency plan is a written account of emergency operation procedures for a PWS. It serves as a type of insurance -- although it may never be used, effective operation in the event of an emergency without one is extremely difficult. Many States require that all PWSs have a written contingency plan. Section 2-5a of AR 420-46 requires written contingency plans for all Army installations. A contingency plan should identify all potential threats to a PWS and include procedures to be followed when such threats materialize. Examples of threats include drought, contamination, power outage, vandalism, and potential terrorism for Army drinking water supplies. Contingency plans should address water use reduction measures and alternate water and power supplies. The plan should be very detailed to include all logistics and specific points of contact with relevant phone numbers. Since the plan is very timely, it should be updated frequently (at least annually) to ensure that it includes the most current information. The State of Washington Department of Social and Health Services, Drinking Water Section of the Office of Environmental Health Programs has produced an excellent Emergency Planning Workbook and other guidance documents for a water system preparing a contingency plan [Drinking Water Section, Office of Environmental Health Programs, Mail Stop LD-11, Olympia, WA, 98504 (206) 753-4299]. Other emergency planning reference materials can be found in Appendix A.

CHAPTER 10
POINT-OF-ENTRY/POINT-OF-USE

10-1. Definitions

Point-of-entry (POE) and point-of-use (POU) treatment devices provide additional or alternative treatment of distributed drinking water at the point of the consumer. POE devices treat the drinking water at the water's entry point to a building to provide water that meets MCLs or ALs throughout the building. Maintenance of POE devices is often the responsibility of the supplier of water. POU devices are tap or location specific treatment devices. They can only provide water that meets standards at one tap, leaving water untreated elsewhere in a building.

10-2. Use

The EPA recognizes that full-scale treatment up-grades/changes are not always the most economical way to provide drinking water in compliance with the NPDWR. In order to provide safe drinking water to all consumers, the NPDWR allows use of POE devices to comply with MCLs or ALs if the POE devices meet certain criteria. The devices must be maintained and operated by the supplier of public water. The PWS must develop and obtain State approval for a monitoring plan prior to using the POE for compliance. The POE device used must provide health protection equivalent to central water treatment, where "equivalent" is defined as providing water that would meet all NPDWR and is as acceptable to the consumer as centrally treated drinking water. The State must require adequate certification of performance, field testing, and, if not included in the certification process, a rigorous engineering design review of the POE device. The POE device cannot jeopardize the microbiological quality of the drinking water, and its design must consider the tendency for increase in heterotrophic bacteria to increase in water treated with activated carbon. Most importantly, all consumers must be protected if POE devices are to be used for compliance. In this case, every building connected to the systems (or every building which exceeds an MCL or AL) must have a POE device installed, maintained, and sufficiently monitored. Public water systems may not use bottled water or POU devices to achieve compliance with an MCL. Bottled water or POU devices may be used, however, as a temporary measure to avoid unreasonable risks to health. The use requirements for non-centralized water treatment devices are contained in 40 CFR 141, Subpart J.

10-3. Considerations

The most important consideration when choosing a POE/POU device is to choose the right device for the desired treatment. Installations should check with the manufacturer to determine what contaminants a particular device is capable of removing and to what level. The National Safety Foundation (NSF) provides a certification program for POE/POU devices, as well as other materials that come in contact with drinking water (to include treatment chemicals). Choosing the proper device from this approved list would ensure consumer safety. A list of approved POE/POU devices which meet the NSF standards can be obtained by writing the NSF at NSF International, 3475 Plymouth Rd., PO Box 130140, Ann Arbor, MI 48113-0140, phone (313) 769-8010, Fax 313-769-0109. Another consideration in deciding whether or not a POE/POU device can meet a water system's needs is the required maintenance and operation of the devices. If an installation plans to use a POE device to achieve compliance, it must be maintained and operated by the installation supplying directorate (DPW/DEH). The device should be located in an area that provides adequate room for normal operations and routine maintenance such as changing filters, as well as non-routine repairs such as parts replacement. POU devices must be used very cautiously with careful consideration given to their maintenance. Biological growth on POU filters can sometimes present more of a risk than the contaminant the filters were installed to remove.

CHAPTER 11
BEYOND THE REQUIREMENTS

11-1. Health Advisories

There are currently 83 contaminants or groups of contaminants with MCLGs and MCLs, ALs or treatment techniques. Consumers served by a PWS are protected from these contaminants. However, there are a number of other contaminants for which a health limit is only proposed and some for which regulated health limits do not exist at all. Consumers can be protected from many of these other contaminants through conscientious use of EPA Health Advisories (HAs). The HAs are developed through risk assessments based upon scientific studies of health effects. Risk is dependent upon both concentration and exposure period. The HAs present limits for contaminants in drinking water based upon various exposure durations. There are several HAs for contaminants which are now regulated. These can be consulted in the event of a contamination episode to determine the risk when exposure will be for a short duration (less than the life-time consumption upon which most MCLs are developed). Common exposure durations for HAs are 1-day, 10-day, longer-term, and life-time. A longer-term duration can be anywhere from a few months up to 7 years and is specifically defined for each HA. One-day and 10-day HA limits are based upon a 10-kilogram (kg) child's consumption. Longer-term HA limits are often given for both 10-kg child and 70-kg adult consumption scenarios. The HAs also provide technical guidance on health effects, analytical methodologies, and treatment technologies. Current HAs can be obtained by contacting the Safe Drinking Water Hotline (1-800-426-4791) or by contacting the USACHPPM Water Supply Management Program at DSN 584-3919, or commercial (410) 671-3919.

11-2. Unreasonable Risk to Health

The EPA has released guidance for States to use when determining what constitutes an unreasonable risk to health (URTH) in issuing variances and exemptions. This same guidance can also be used to determine acceptable exposure levels in situations of temporary contamination of drinking water supplies. Guidance in Developing Health Criteria for Determining Unreasonable Risk to Health is a draft document available from the Safe Drinking Water Hotline that gives guidance in determining URTHs for various regulated contaminants. The URTH guidance establishes Upper Bound Levels (UBLs) for contaminants, which present an unreasonable risk to consumer health when exceeded. The health criteria for determining a URTH are based upon an evaluation of the toxicity exhibited by individual contaminants. Consideration is given to both carcinogenic and non-carcinogenic health effects. The UBL is established based upon MCLGs, MCLs, longer-

TABLE 11-1. URTH GUIDANCE (in mg/L)

Contaminant	MCLG (mg/L)	MCL (mg/L)	EPA URTH Level
Inorganics			
Asbestos (>10 μm)	7 MFL*	7 MFL	7 MFL
Cadmium	0.005	0.005	0.005
Copper	1.3	1.3	1.3
Fluoride	4	4	5
Mercury	0.002	0.002	0.01
Nitrate	10	10	10
Nitrite	1	1	1
Nitrate/Nitrite	10	10	10
Selenium	0.05	0.05	0.1
Microbiological			
Total Coliforms	0	5%/1%	5%/1%
Organics			
Acrylamide	0	TT+	0.001
Alachlor	0	0.002	0.04
Atrazine	0.003	0.003	0.03
Benzene	0	0.005	0.01
Carbofuran	0.04	0.04	0.05
Carbon Tetrachloride	0	0.005	0.03
Chlordane	0	0.002	0.003
2,4-D	0.07	0.07	0.1
DBCP	0	0.0002	0.003
cis-1,2-DCE	0.07	0.07	0.4
trans-1,2-DCE	0.1	0.1	2
o-DCB	0.6	0.6	9
p-DCB	0.075	0.075	0.75
1,2-Dichloroethane	0	0.005	0.04
1,1-Dichloroethylene	0.007	0.007	0.07
1,2-Dichloropropane	0	0.005	0.06
Epichlorohydrin	0	TT	0.07
Ethylbenzene	0.7	0.7	1
EDB	0	0.00005	0.00005
Heptachlor	0	0.0004	0.0008
Heptachlor Epoxide	0	0.0002	0.0004
Lindane	0.0002	0.0002	0.002
Methoxychlor	0.4	0.4	0.5
Monochlorobenzene	0.1	0.1	2
PCBs	0	0.0005	0.0005
Tetrachloroethylene	0	0.005	0.07
Toxaphene	0	0.003	0.003
2,4,5-TP	0.05	0.05	0.07
1,1,1-Trichloroethane	0.2	0.2	1
Trichloroethylene	0	0.005	0.3
Vinyl Chloride	0	0.002	0.002
Xylenes	10	10	40

* MFL is million fibers per liter.
\+ TT is treatment technique.

term HAs for a child, cancer classifications, the 10^{-4} cancer risk level, and safety factors of 1-10 for possible carcinogens. Since risk assessments are time dependent, the EPA recommends a maximum of 7 years for exposure to a UBL, based upon non-carcinogenic effects. Table 11-1 summarizes published URTH levels.

11-3. Alternate Water Supplies

In the past, the Army has supplied alternate water in situations when the regular water supply exceeds an MCL (onpost and offpost, if the Army was considered to have a possible role in or was responsible for the contamination). In April 1991, a task force was assembled at the USAEHA (now USACHPPM) to study the issue of a formal alternative water supply policy. The result was never issued as formal Army policy; however, it remains USACHPPM recommended guidance. The recommendation is as follows. Army should promote consumer health in contaminated drinking water situations. Alternative drinking water response action criteria should be the EPA MCLs or similarly conservative health-based criteria in the absence of MCLs where the duration of the exposure period cannot be sufficiently defined. In cases where the exposure period can be defined/controlled, more relaxed action criteria based on an EPA unreasonable risk to health approach can be used. In OCONUS environments, the foregoing response action criteria or ones consistent with host nation requirements should be followed, whichever are more stringent. Alternative water supplies should be implemented in accordance with applicable regulations. Economic and public relations aspects can be considered in alternative water supply decision-making, provided the risk to consumer health is not increased. Specified Army authorities must approve any response to contamination of drinking water supplies caused by Army activities. It should be noted that alternative water supplies may constitute an interim measure (i.e., bottled water or installation of POU devices) or a more permanent measure, such as connecting to a neighboring PWS. Provision of any interim alternative water supply measures shall cease once the original water supply has been restored to an acceptable use condition or when a permanent approved water supply is provided.

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APPENDIX C
RULES AND REGULATED CONTAMINANTS

Drinking Water Rules and Affected Systems

RULES	SYNOPSIS	CWS	NTNC	TNC
Lead and Copper Rule	Regulated lead and copper concentrations at the consumer's tap	X	X	
NIPDWR	Current MCLs for TTHMs , Arsenic, and Radionuclides	X		
Phase I	Regulated 8 VOCs	X	X	
Phase IA	MCL for Fluoride	X		
Phase II	Regulated several SOCs and IOCs	X	X	X[1]
Phase V	Regulated more VOCs , SOCs and IOCs	X	X	
Surface Water Treatment Rule	Filtration and disinfection requirements for systems which use surface water or a ground water directly influenced by surface water	X	X	X
Total Coliform Rule	Regulates total coliform and fecal coliforms (or E. coli) in distributed drinking water	X	X	X
PROPOSED AND FUTURE RULES				
Disinfectants and Disinfection By-Products	Sets more stringent regulations for TTHMs, sets MCLs for other disinfection by-products and sets limits for disinfectant residuals in distributed drinking water	X	X	X[2]
Enhanced Surface Water Treatment Rule	Strengthens the existing SWTR	X	X	X
Ground Water Disinfection Rule	Sets minimum disinfection criteria for systems using ground water	X	X	X
Information Collection Rule	Requires affected systems to collect monitoring data for microbiological contaminants and disinfection by-products	X	X	
Radionuclides Rule (Phase III)	Updates MCLs for radionuclides	X	X	

Key: CWS- community water systems; NTNC- non-transient non-community water systems; TNC- transient non-community water systems; NIPDWR- National Interim Primary Drinking Water Regulations; MCL- Maximum Contaminant Level; TTHMs- total trihalomethanes; VOCs- volatile organic chemicals; SOCs- synthetic organic chemicals; IOCs- inorganic chemicals; SWTR- Surface Water Treatment Rule.

1 - Only the nitrate, nitrite and total nitrate/nitrite MCLs apply to transient water systems.

2 - TNC systems using chlorine dioxide must comply with the disinfectant residual limit for chlorine dioxide.

National Interim Primary Drinking Water Regulations

Organics	
2,4-D	0.1*
Endrin	0.0002*
Lindane	0.0004*
Methoxychlor	0.1*
Toxaphene	0.005*
2,4,5-TP (Silvex)	0.01*
Trihalomethanes (sum of chloroform, bromoform, bromodichloromethane, dibromochloromethane)	0.10
Inorganics	
Arsenic	0.05
Barium	1.0*
Cadmium	0.010*
Chromium	0.05*
Fluoride	1.4-2.4* (temp. based)
Lead	0.05*
Mercury	0.002*
Nitrate(as N)	10*
Selenium	0.01*
Sodium and corrosion	No MCL. Monitoring and reporting only.
Radionuclides	
Beta particle and photon radioactivity	4 mrem. (annual dose equiv.)
Gross alpha particle activity	15 pCi/L
Radium-226 plus radium-228	5 pCi/L
Microbials	
Coliforms	<1/100mL
Turbidity	1 NTU

*** - Renewed MCL assigned in Phase II.**

Phase I

Organics

Volatile Organic Chemicals

Benzene	0.005
Carbon tetrachloride	0.005
para-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.20
Trichloroethylene	0.005
Vinyl chloride	0.002

Monitoring Only

List 1 - must be monitored by all systems

Bromobenzene	
Bromodichloromethane	
Bromoform	
Bromomethane	
Chlorobenzene	
Chlorodibromomethane	
Chloroethane	
Chloroform	
Chloromethane	
o-Chlorotoluene	
p-Chlorotoluene	
Dibromomethane	
m-Dichlorobenzene	
o-Dichlorobenzene	(regulated under Phase II)
trans-1,2-Dichloroethylene	(regulated under Phase II)
cis-1,2-Dichloroethylene	(regulated under Phase II)
Dichloromethane	(regulated under Phase V)
1,1-Dichloroethane	
1,2-Dichloropropane	(regulated under Phase II)
1,3-Dichloropropane	
2,2-Dichloropropane	
1,1-Dichloropropene	
1,3-Dichloropropene	
Ethylbenzene	(regulated under Phase II)
Styrene	(regulated under Phase II)
1,1,1,2-Tetrachloroethane	
1,1,2,2-Tetrachloroethane	
Tetrachloroethylene	(regulated under Phase II)
1,1,2-Trichloroethane	(regulated under Phase V)
1,2,3-Trichloropropane	
Toluene	(regulated under Phase II)
p-Xylene	(Total Xylenes regulated
o-Xylene	under Phase II)
m-Xylene	

List 2 - must be monitored by "vulnerable" systems

Ethylene dibromide (EDB)	(regulated under Phase II)
1,2-Dibromo-3-chloropropane (DBCP)	(reg. under Phase II)

List 3 - may be monitored by system upon state's discretion

Bromochloromethane
n-Butylbenzene
Dichlorodifluoromethane

Fluorotrichloromethane	
Hexachlorobutadiene	
Isopropylbenzene	
p-Isopropyltoluene	
Naphthalene	
n-Propylbenzene	
sec-Butylbenzene	
tert-Butylbenzene	
1,2,3-Trichlorobenzene	
1,2,4-Trichlorobenzene	(regulated under Phase V)
1,2,4-Trimethylbenzene	
1,3,5-Trimethylbenzene	

Phase IA (The Fluoride Rule)

Fluoride	4.0

Surface Water Treatment Rule

Giardia lamblia	
Legionella	Treatment techniques
Heterotrophic plate count	
Turbidity	MCL dependent upon system type.

Total Coliform Rule

Total coliform bacteria	
Fecal coliform bacteria	MCL based upon presense-absense
E. coli	test.

Lead and Copper Rule

Lead	Treatment techniques
Copper	

Phase II (SOCs and IOCs)

Inorganics	
Asbestos	7 million fibers/L (>10um)
Barium	2
Cadmium	0.005
Chromium	0.1
Mercury	0.002
Nitrate (as N)	10
Nitrite (as N)	1
Selenium	0.05
Organics	
Volatile Organics	
cis-1,2-Dichloroethylene	0.07
1,2-Dichloropropane	0.005
Ethylbenzene	0.7
Monochlorobenzene	0.1
o-Dichlorobenzene	0.6
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1
trans-1,2-Dichloroethylene	0.1
Xylenes (total)	10
Pesticides/Herbicides	
Alachlor	0.002
Aldicarb	see below
Aldicarb Sulfone	see below
Aldicarb Sulfoxide	see below
Atrazine	0.003
Carbofuran	0.04
Chlordane	0.002
Dibromochloropropane (DBCP)	0.0002
2,4-D	0.07
Ethylene dibromide (EDB)	0.00005
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Lindane	0.0002

Methoxychlor	0.04
PCBs	0.0005
Pentachlorophenol	0.001
Toxaphene	0.003
2,4,5-TP (Silvex)	0.05

Treatment Chemicals

Acrylamide — Treatment Techniques

Epichlorophydrin

Monitoring Only

Organics

Aldrin

Aldicarb — (MCLs for three Aldicarb contaminants

Aldicarb Sulfoxide — postponed pending EPA's reconsideration

Aldicarb Sulfoxide — of the MCLs and MCLGs)

Benzo(a)pyrene — (regulated under Phase V)

Butachlor

Carbaryl

Dalapon — (regulated under Phase V)

Di-2(ethylhexyl)adipate — (regulated under Phase V)

Di-2(ethylhexyl)phthalates — (regulated under Phase V)

Dicamba

Dieldrin

Dinoseb — (regulated under Phase V)

Diquat — (regulated under Phase V)

Endothall — (regulated under Phase V)

Glyphosate — (regulated under Phase V)

Hexachlorobenzene — (regulated under Phase V)

Hexachlorocyclopentadiene — (regulated under Phase V)

3-Hydroxycarbofuran

Methomyl

Metolachlor

Metribuzin

Oxamyl (vydate) — (regulated under Phase V)

Picloram — (regulated under Phase V)

Propachlor

Simazine — (regulated under Phase V)

2,3,7,8-TCDD (dioxin) — (regulated under Phase V)

Inorganics

Antimony — (regulated under Phase V)

Beryllium — (regulated under Phase V)

Cyanide — (regulated under Phase V)

Nickel — (regualted under Phase V)

Sulfate

Thallium — (regulated under Phase V)

NOTE: When acrylamide and/or epichlorohydrin are used in the treatment of drinking water, the state must be notified annually in writing. Dosages of the chemicals may not exceed 0.05% dosed at 1 ppm for acrylamide, or 0.01% dosed at 20 ppm for epichlorohydrin.

Phase V (SOCs and IOCs)

Inorganics	
Antimony	0.006
Beryllium	0.004
Cyanide	0.2
Nickel	0.1
Thallium	0.002
Organics	
Volatile Organics	
Dichloromethane	0.005
1,2,4-Trichlorobenzene	0.07
1,1,2-Trichloroethane	0.005
Pesticides/Herbicides	
Dalapon	0.2
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Glyphosate	0.7
Oxamyl (Vydate)	0.2
Picloram	0.5
Simazine	0.004
Other Organics	
Benzo(a)pyrene	0.0002
Di(2-ethylhexyl)adipate	0.4
Di(2-ethylhexyl)phthalate	0.006
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
2,3,7,8-TCDD (Dioxin)	3 X 10E(-8)

APPENDIX D
STATUS OF FEDERAL REGULATIONS

STATUS OF PROPOSED REGULATIONS

Proposed Rule	Proposal Published	Status	Congressional Activity
Disinfectants and Disinfection By-Products	29 July 94 (59 FR 38668)	Public comment period closed 29 December 1994. USEPA reviewing public comments. Stage 1 to be finalized December 1996.	Regulation deadlines may be included in reauthorized SDWA.
Enhanced Surface Water Treatment Rule	29 July 94 (59 FR 38832)	Public comments being accepted until 30 May 1996.	Regulation deadlines may be included in reauthorized SDWA.
Information Collection Rule	10 February 94 (59 FR 6332)	USEPA evaluating public comments. Final rule delayed to December 1995.	Regulation deadlines may be included in reauthorized SDWA.
Radionuclides	18 July 91 (56 FR 33056)	New schedule being developed.	Congress prohibited USEPA from spending FY 95 money to promulgate a radon standard.
Sulfate	20 December 94 (59 FR 65578)	Court-ordered deadline is 31 May 1996 for a final rule.	

STATUS OF ANTICIPATED REGULATIONS

Anticipated Rule	Proposal Published	Status
Reconsideration of the Aldicarb, Aldicarb Sulfoxide, Aldicarb Sulfone MCLs	New schedule being developed.	Final rules set 1 July 1991 (56 FR 30266); MCLs postponed 27 May 1991 (57 FR 22178); USEPA has decided to revise the MCLs upward.
Arsenic Rule	30 November 95 deadline for proposal; 30 November 97 deadline for final rule. New schedule expected.	USEPA is considering a new MCL between 0.002 to 0.020 mg/L.
Ground-Water Disinfection Rule	30 August 95 deadline for proposal; 30 August 97 deadline for final rule. New schedule expected.	USEPA released a draft rule 31 July 1992. (57 FR 33960)
Phase VIb SOCs and IOCs.	New schedule being developed.	USEPA has informally released draft rule.

APPENDIX E
BEST AVAILABLE TECHNOLOGIES

BEST AVAILABLE TECHNOLOGIES FOR REMOVAL OF CONTAMINANTS FROM DRINKING WATER

Inorganics	
Antimony	2,7
Arsenic	2,5,6,7
Asbestos	2,3,8
Barium	5,6,7,9
Beryllium	2,5,6,7
Cadmium	2,5,6,7
Chromium	2,5,6[2],7
Copper	2,5,6,7,8
Cyanide	5,7,10
Fluoride	1,7
Lead	2,5,6,7,8
Mercury	2[1],4,6[1],7[1]
Nickel	5,6,7
Nitrate	5,7,9,13
Nitrite	5,7
Selenium	1,2[3],5[4],6,7,9[3]
Thallium	5,7
Organics	
Alachlor	4
Atrazine	4
Benzene	4,12
Benzo(a)pyrene	4
Carbofuran	4
Carbon tetrachloride	4,12
Chlordane	4
cis-1,2-Dichloro-ethylene	4,12
Dalapon	4
1,1-Dichloroethylene	4,12
1,2-Dichloroethane	4,12
1,2-Dichloropropane	4,12
2,4-D	4
Di(2-ethylhexyl)adipate	4,12
Di(2-ethylhexyl)phthalate	4
Dibromochloro-propane (DBCP)	4,12
Dichloromethane	12
Dinoseb	4
Diquat	4
Endotall	4
Endrin	4
Ethylbenzene	4,12
Ethylene dibromide (EDB)	4,12
Glyphosate	10
Heptachlor epoxide	4
Heptachlor	4
Hexachlorobenzene	4
Hexachlorocyclo-pentadiene	4,12
Lindane	4
Methoxychlor	4
Monochlorobenzene	4,12
o-Dichlorobenzene	4,12
Oxamyl (Vydate)	4
para-Dichlorobenzene	4,12
PCBs	4
Pentachlorophenol	4,12
Picloram	4
Simazine	4
Styrene	4,12
1,1,1-Trichloroethane	4,12
1,1,2-Trichloroethane	4,12
1,2,4-Trichlorobenzene	4,12
2,3,7,8-TCDD (Dioxin)	4
2,4,5-TP (Silvex)	4
Tetrachloroethylene	4,12
Toluene	4
Toxaphene	4,12
trans-1,2-Dichloro-ethylene	4,12
Trichloroethylene	4,12
Vinyl chloride	12
Xylenes (total)	4,12
Radiologicals	
Gross alpha	7
Gross beta	5,7
Radium 226	5,6,7
Radium 228	5,6,7
Radon	12
Uranium	5,7,6,2

1 Activated Alumina
2 Coagulation/Filtration
3 Direct/Diatomaceous Filt.
4 Granular Activated Carbon
5 Ion Exchange
6 Lime Softening
7 Reverse Osmosis
8 Corrosion Control
9 Electrodialysis
10 Oxidation (chlorine or ozone)
11 Ultraviolet
12 Packed Tower Aeration

[1] BAT for influent concentrations of Hg <10 µg/L. [2] BAT for Chromium III only. [3] BAT for Selenium IV only. [4] BAT for Selenium VI only.

GLOSSARY

SECTION 1 - ABBREVIATIONS

AR	Army Regulation
AWWA	American Water Works Association
AL	Action Level
BAT	Best Available Technology
CAPA	Critical Aquifer Protection Area
CFR	Code of Federal Regulations
CONUS	Continental United States
CT	Concentration X Time
CWS	Community Water System
DBCP	Dibromochloropropane
DBP	Disinfectant By-Product
DDBP	Disinfectants and Disinfection By-Products
DEH	Directorate of Engineering and Housing
DOD	Department of Defense
DPW	Department of Public Works
DWPL	Drinking Water Priority List
EDB	Ethylene Dibromide
EPA	U.S. Environmental Protection Agency
ESWTR	Enhanced Surface Water Treatment Rule
FR	Federal Register
GW	Ground Water
GWDR	Ground-Water Disinfection Rule
GWUDI	Ground Water Under Direct Influence (of surface water)
HA	Health Advisory
ICR	Information Collection Rule
IMA	Installation Medical Authority
IOC	Inorganic Chemical
kg	kilogram
LCCA	Lead Contamination Control Act
LSI	Langelier Saturation Index
MACOM	Major Army Command
MCA	Military Construction, Army
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDL	Method Detection Limit
MMO	Minimal Medium ONPG
MUG	4-methyl-umbelliferyl-β-d-glucuronide
mg/L	milligrams per liter
μg/dL	micrograms per deciliter

µg/L	micrograms per liter
MRDL	Maximum Residual Disinfectant Level
MRDLG	Maximum Residual Disinfectant Level Goal
NCWS	Noncommunity Water System
NIPDWR	National Interim Primary Drinking Water Regulations
NPDWR	National Primary Drinking Water Regulations
NSDWR	National Secondary Drinking Water Regulations
NSF	National Safety Foundation
NTNC	Nontransient Noncommunity (water system)
NTWS	Nontransient Water System
NTU	Nephelometric Turbidity Unit
OCONUS	Outside CONUS
OEBGD	Overseas Environmental Baseline Guidance Document
O&M	Operations and Maintenance
OMA	Operations & Maintenance, Army
ONPG	ortho-nitrophenyl-β-d-galactopyranoside
PCBs	Polychlorinated Biphenyls
pCi/L	picocurries per liter
PHS	Public Health Service
PL	Public Law
POE	Point-of-Entry
POU	Point-of-Use
psi	pounds per square inch
PVNTMED	Preventive Medicine
PWS	Public Water System
RAA	Running Annual Average
SDWA	Safe Drinking Water Act
SMCL	Secondary Maximum Contaminant Level
SOC	Synthetic Organic Chemical
SOFA	Status of Forces Agreement
SSAD	Sole Source Aquifer Demonstration
SW	Surface Water
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
TNC	Transient Noncommunity (water system)
TTHM	Total Trihalomethane
TWS	Transient Water System
UBL	Upper Bound Level
UIC	Underground Injection Control
URTH	Unreasonable Risk to Health
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency

USAPACEHEA	U.S. Army Pacific Environmental Health Engineering Agency
UV	ultra-violet
VOCs	Volatile Organic Compounds
WHP	Wellhead Protection
WHPA	Wellhead Protection Area

SECTION 2 - TERMS

action level (AL)
the concentration of lead or copper in tap water samples which triggers the treatment requirements outlined in the Lead and Copper Rule.

best available technology (BAT)
best means available for treating water in order to meet an MCL or AL. BATs are determined by the EPA after examination of efficacy under field conditions and economic feasibility. Sometimes different BATs are chosen for various system sizes due to varied economic capabilities.

community water system (CWS)
a public water system which serves year-round residents.

compliance cycle
the 9-year calendar cycle consisting of three 3-year compliance periods during which public water systems must monitor.

compliance period
the 3-year calendar period (based upon the calendar year) upon which public water systems' monitoring frequencies are set.

contaminant
any physical, chemical, biological, or radiological substance or matter in water at a level which may cause adverse effects (health or aesthetic).

CT or CT calculation
the product of "residual disinfectant concentration" (C) in mg/L determined before or at the first customer, and the corresponding "disinfectant contact time" (T) in minutes.

disinfectant
any oxidant, including, but not limited to, chlorine, chlorine dioxide, chloramine and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

drinking water priority list (DWPL)
a list of known and potential contaminants in drinking water. The list is updated every 4 years using results from unregulated contaminant monitoring. The SDWA Amendments of 1986 mandate the EPA to regulate 25 contaminants from this list every 3 years.

first draw sample
a 1-liter sample of tap water, collected for monitoring under the Lead and Copper Rule, that has been standing still in plumbing pipes for at least 6 hours and is collected without flushing the tap.

ground water under the direct influence (of surface water) (GWUDI)
any water beneath the surface of the ground with (1) a significant occurrence of insects or other microorganisms, algae, or large-diameter pathogens such as Giardia lamblia, or (2) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions.

maximum contaminant level (MCL)
the maximum permissible level of a contaminant in drinking water provided to the public. The MCLs are enforceable levels to protect the health of consumers.

maximum contaminant level goal (MCLG)
the maximum level of a contaminant in drinking water at which no known or anticipated health effects would occur, and which allows for an adequate margin of safety. The MCLGs are not Federally enforceable, however, providers of drinking water should strive to meet these established goals.

method detection limit
the contaminant concentration that when processed through the complete analytical method, produces a signal with a 99% probability that is different from the blank.

nontransient noncommunity water (NTNC) system
a public water system which serves the same people daily, but for less than 24 hours a day, or which serves the same people (not year round residents) for at least 6 months of the year.

point-of-entry (POE) treatment device
a treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.

point-of-use (POU) treatment device
a treatment device applied to a single tap for the purpose of reducing contaminants in drinking water at that one tap.

primacy
administration and enforcement responsibility for drinking water regulations given to governing entities by the EPA.

public water system (PWS)
a system which supplies drinking water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 people daily at least 60 days out of the year.

running annual average (RAA)
the 12-month average concentration of a chemical in samples collected more frequently than annually, where new sampling results replace the oldest results to maintain a constant 12-month average. For example, the RAA of an organic contaminant detected in January (10 μg/L), April (23 μg/L), July (15 μg/L), and October (5 μg/L) would be 13 μg/L. When samples collected the following January contain only 4 μg/L of the contaminant, the 4 μg/L result would replace last January's 10 μg/L result and the RAA would be 12 μg/L.

secondary maximum contaminant level (SMCL)
recommended limits (not Federally enforceable) for contaminants in drinking water which affect its aesthetic quality (color, taste, odor, staining).

State
reference to the regulatory authority for drinking water.

supplier of water
any person who owns or operates a public water system.

surface water
all water which is open to the atmosphere and subject to surface water run-off.

transient noncommunity (TNC) water system
a public water system which serves different people daily for at least 60 days out of the year.

waterborne disease outbreak
the significant occurrence of acute infectious illness, epidemiologically associated with the ingestion of water from a public water system which is deficient in treatment, as determined by the appropriate local or State agency.

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